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January 9, 2019

Laura Castrilli
RCRA Project Coordinator
EPA

Subject: Conditional Approval of Final Stormwater Source Control Measure Work Plan (Work Plan)
Univar USA Inc. Portland, Oregon
Univar Portland (NW Yeon)

Dear Ms. Castrilli,

Ms. Castrilli,

This letter was prepared by ERM-West, Inc. (ERM) on behalf of Univar USA Inc. (Univar) for the Univar property located at 3950 NW Yeon Avenue, Portland, Oregon (the "Property"). The purpose of this letter is to provide additional details on the collection of surface wipe samples and a new laboratory Quality Assurance Project Plan (QAPP) per the United States Environmental Protection Agency's (EPAs) request in the *Conditional Approval of Final Stormwater Source Control Measure Work Plan* dated December 4, 2018 (the "Conditional Approval").

In accordance with the Conditional Approval, the following attachments are included with this letter:

- A Standard Operating Procedure for conducting surface wipe sampling is included as Attachment A.
- The laboratory has changed from Test America to ALS Global (ALS) in order to meet the proposed laboratory detection and reporting limits detailed in the Final Stormwater Source Control Measure (SWSCM) Work Plan dated October 2, 2018. A revised QAPP and associated Quality Assurance Manual from ALS is included as Attachment B.

With submittal of this letter, ERM has completed the requirements of the Conditional Approval and will move forward with implementation of the Final SWSCM Work Plan.

Please let me know if you have any questions.

Sincerely,

Brendan Robinson, P.E.
Project Manager

ATTACHMENT A WIPE SAMPLE SOP

January 9, 2019

ATTACHMENT A – STANDARD OPERATING PROCEDURE FOR SURFACE WIPE SAMPLES

The purpose of this document is to provide standard operating procedures (SOPs) to be followed during collection of surface wipe samples at the Univar facility located at 3950 NW Yeon Avenue in Portland, Oregon (the site). These SOPs will provide the information and procedures necessary to collect samples that provide accurate and meaningful information about the characteristics of the surface contaminants at the site.

This SOP is based on methodology described in NIOSH 100 “Lead in Surface Wipe Samples” from the NIOSH Manual of Analytical Methods.

PREPARATION

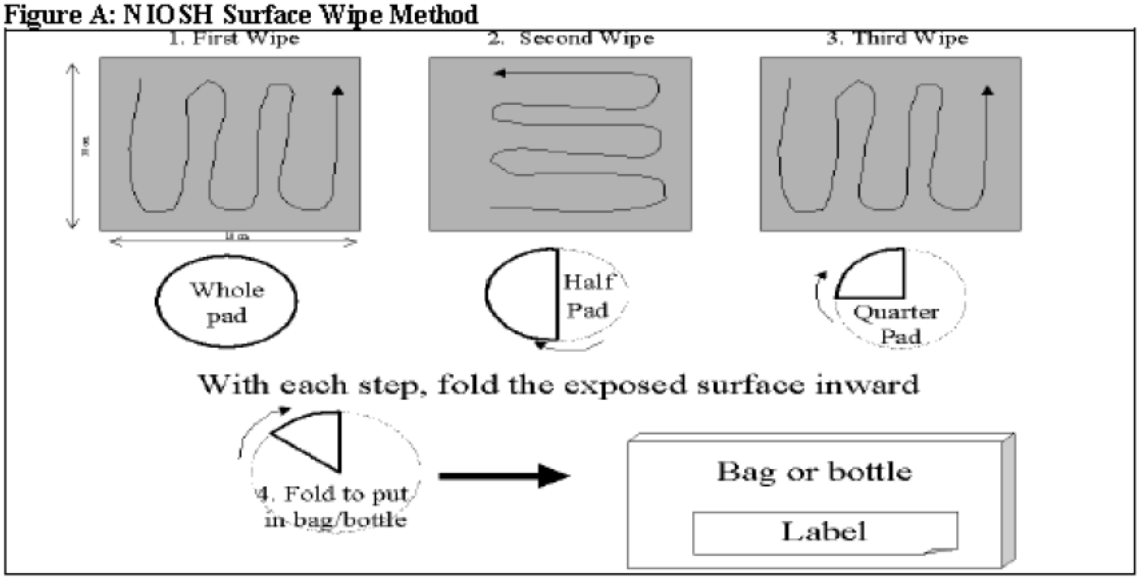
ALS Environmental, the analytical laboratory that will analyze the samples collected at the site, should be contacted in advance to provide the required sampling containers and coolers. The equipment required for sampling should be gathered and stored in a field kit, and should include:

- Sample Container: bag, plastic, sealable with “zip” type seal.
- Sample Media: Pre-moistened wipe kit from ALS Environmental.
- Gloves: Natural latex rubber, Nitrile, PVC, or Polyethylene
- Template: Plastic sheet or cardboard: 100cm^2: 10 cm x 10 cm square –or- circle of 11.24 cm diameter.

SAMPLE COLLECTION

A manual wipe sample is collected by following the below NIOSH method, as illustrated in Figure A.

Figure A: NIOSH Surface Wipe Method



The sampler should follow the steps below:

1. Pre-label as much information as possible on the sample containers. Wear disposable, powder-free gloves when handling and filling sample containers.
2. Mark sampling location(s) using the template to ensure entire sampling area is identified. One wipe sample should be collected per sample location (i.e., do not collect more than one wipe sample from each wipe area).
3. Select the appropriate laboratory supplied wipe specific to the required analysis (e.g., use a metals wipe for metals analysis).

4. Using the whole wipe pad, wipe the entire sampling area in a single vertical S path as shown in Figure A. Fold the wipe in half with exposed surface facing inward.
5. Conduct second wipe in a single horizontal S path as shown in Figure A. Fold the wipe in half with exposed surface facing inward.
6. Conduct third wipe in a single vertical S path as shown in Figure A. Fold the wipe in half again and place into pre-labeled bag.
7. Place collected wipe sample in their plastic bags into a container to send to laboratory. Coolers and ice are not necessary to keep wipe samples preserved.
8. Fill out chain-of-custody completely and place in container with laboratory samples.
9. Coordinate with ALS Environmental for drop-off or pick-up of samples ensuring that all holding times for specific analyses will be met.

RECORDKEEPING

Detailed records of sampling activities conducted during surface wipe sampling should be kept in a field notebook. The information included in the sampling records should include:

- Date and time of sampling
- Weather conditions
- Name of sampler
- Sample location
- Collection method (i.e. by hand, with wipe)
- Sample containers filled (number, size, method)
- Any unusual circumstances encountered during sampling

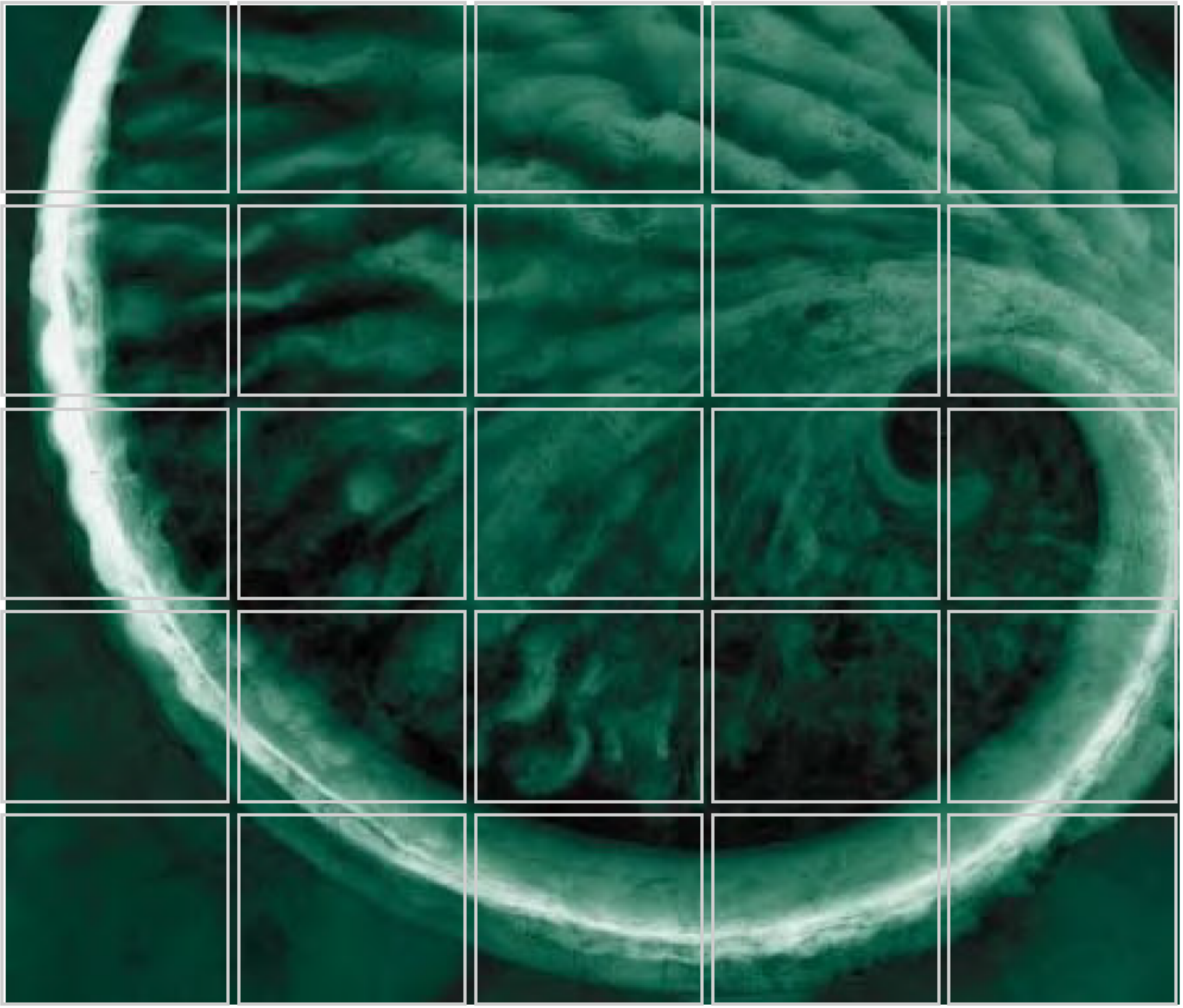
REFERENCES

Brookhaven National Laboratory, *IH75190 Surface Wipe Sampling for Metals*. IH75190. June 2017.

NIOSH: Manual of Analytical Method, Method 9100: *Lead in Surface Wipe Samples*.

ATTACHMENT B QAPP and LABORATORY QAM

January 9, 2019



Quality Assurance Project Plan

3950 NW Yeon Avenue
Portland, Oregon

December 2018

www.erm.com

Prepared for:
Univar USA Inc.

The business of sustainability

ERM

Univar USA Inc.

Quality Assurance Project Plan

Univar USA Inc.
3950 NW Yeon Avenue
Portland, Oregon

December 2018

Project No. 0487089

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1.0 DISTRIBUTION LIST

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EPA RCRA Project Coordinator: Laura Castrilli

Univar Project Manager: Steven Roach

ERM Project Manager: Brendan Robinson

ERM Project QA Coordinator: Rachel Smith

ALS Environmental Project Manager: Howard Boorse

2.0 PROJECT MANAGEMENT

2.1 INTRODUCTION AND PROJECT ORGANIZATION

This Quality Assurance Project Plan (QAPP) presents the quality assurance (QA) and quality control (QC) objectives, organization, and functional activities associated with the sampling and analyses of stormwater, catch basin solids and surface wipe samples obtained during the stormwater source control evaluation to characterize stormwater discharges at the site. This work is being conducted on behalf of Univar USA Inc. (Univar) at the Univar facility located at 3950 NW Yeon Avenue in Portland, Oregon (the site) in accordance with the *Stormwater Source Control Evaluation Work Plan* (the work plan). This QAPP is prepared in general accordance with the United States Environmental Protection Agency (EPA) guidance for the preparation of QAPPs (USEPA 2002).

The purpose and objectives of the stormwater, catch basin solids, and surface wipe sampling are described in the work plan.

As part of this project, Environmental Resources Management (ERM) will assist with the data analysis and reporting under contract with Univar. Under contract with Univar, ALS Environmental (ALS), will be performing the analyses for water, solids, and wipes.

Contact information for key personnel for the stormwater source control evaluation (SCE) project is provided in Table 1.

2.1.1 Tasks Description

The tasks to be completed for this project include field sampling, laboratory analysis, data quality evaluation, data management, data analysis, and reporting.

The tasks to be completed in the field are detailed in the work plan, which includes procedures for:

- Field activity documentation;
- Sampling equipment;
- Sample collection and handling;

- Sample identification and chain-of-custody; and
- Equipment decontamination.

The types of samples to be collected and the analytical methods that will be used are presented in the work plan. The work plan also includes the applicable Portland Harbor Record of Decision (ROD) Cleanup Levels (CULs) and the Joint Source Control Strategy Screening Level Values (JSCS SLVs) for parameters without Portland Harbor CULs. Sample locations and rationale are provided in the work plan. The laboratories will report the results in hardcopy and as an electronic data deliverable in a format suitable for importing into the site database. ERM will perform the data validation and data quality assessment.

2.1.2 Data Quality Objectives

The purpose of this QAPP is to describe the requirements and/or criteria necessary to produce data of sufficient technical quality to assist in characterizing stormwater across the site. This is achieved through the assessment of data quality measures, including precision, accuracy (bias), representativeness, completeness, comparability, and data reporting limits against the quality control criteria.

Data Quality Objectives (DQOs) are qualitative and/or quantitative statements to ensure that data of known and appropriate quality are collected to support specific decisions or answer specific regulatory requirements. The DQOs describe what data are needed, why the data are needed, and how the data will be used to address the problem being investigated. DQOs also establish numeric limits for the data to allow the data user (or reviewers) to determine whether data collected are of sufficient quality for their intended use.

The project DQO for this stormwater Source Control Evaluation is to:

- Characterize the stormwater collected from various locations across the site to determine if the stormwater system is a source of contamination to the Portland Harbor. The characterization will be used as a basis for planning interim remedial measures (IRMs) or storm system improvements (if needed).

2.1.3 *Data Quality Control*

Data generated during the project will provide the basis for decisions on potential sources of contamination to stormwater and suitable mitigation methods (if necessary). In order to support this use, and to fulfill project objectives, useable data are required.

The usability of the data collected during this project depends on its quality established through a QC review. Multiple factors affect the quality of data, including sample collection methods and analytical methods. Following standard operating procedures (SOPs) for both sample collection and analysis will reduce sampling and analytical error. Complete chain-of-custody documentation, adherence to required sample preservation techniques, holding times and proper shipment methods ensure sample integrity.

Quantification limit objectives are based on the extent to which the laboratory equipment, field equipment, or analytical process, can provide accurate data measurements of reliable quality for specific constituents in field samples. The actual quantification limit for a given analysis will vary depending on instrument sensitivity and matrix effects.

2.1.4 *Data Quality Indicators and Method Quality Objectives*

The data quality indicators (DQIs) presented in this section are: precision, accuracy, representativeness, comparability, completeness, sensitivity (PARCCS), and the additional indicator of selectivity. PARCCS can be applied to both field and laboratory analytical measurements to ensure that data of known and appropriate quality are obtained to support specific decisions or regulatory actions. Selectivity is a data quality indicator that applies specifically to laboratory data to ensure that reported data are representative of the reported compound and not of a positive or negative artifact.

Method quality objectives (MQOs) are project-specific requirements for the DQIs. The MQOs are selected to support any statistical requirements of the analytical data. Because this project involves a preliminary survey, and follow-up will be required if contamination is identified, it has been determined that standard laboratory acceptance limits will be sufficient to meet project objectives to characterize water and sediment for constituents of interest. A discussion of the DQIs follows below:

Precision. Precision is defined as the degree of agreement between or among independent, similar, or repeated measures. Precision is expressed in terms of analytical variability and will be calculated intra-laboratory. For this project, analytical variability will be measured as the relative percent difference (RPD) or coefficient of variation between analytical replicates/duplicates (i.e., field or laboratory) and between the matrix spike (MS) and matrix spike duplicate (MSD) analytical results. Short-term precision will be measured since the duplicates will be analyzed at the same time the primary samples are analyzed.

Where:

$$\% RPD_i = \left(\frac{|O_i - D_i|}{\frac{(O_i + D_i)}{2}} \right) * 100$$

%RPDi = Relative percent difference for compound i

Oi = Value of compound i in original sample or MS

Di = Value of compound i in duplicate sample or MSD

The resultant RPD will be compared to acceptance criteria and deviations from specified limits reported. If the acceptance criteria are not met, the laboratory or laboratories will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions.

Accuracy. Accuracy is the amount of agreement between a measured value and the true value. It will be measured as the percent recovery (%R) of the matrix spike/matrix spike duplicate (MS/MSD), laboratory control samples, and surrogate spike compounds. It also will be measured using the analytical results of instrument calibration and other laboratory internal standards.

Accuracy will be calculated as the %R of analytes as follows:

Where:

%Ri = percent recovery for compound i

Yi = measured analyte concentration in sample i
(measured - original sample concentration)

Xi = known analyte concentration in sample i

The resultant percent recoveries will be compared to acceptance criteria and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory or laboratories will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions.

Representativeness. Representativeness is the degree to which data accurately and precisely represent a parameter variation at a sampling point or an environmental condition. During the SCE, the results of all analyses will be used to evaluate the data to determine if the samples were collected in a manner such that the results appropriately describe the area investigated.

Comparability. Comparability is the degree to which data from one study can be compared with data from other similar studies, reference values (such as background), reference materials, and screening values. This goal will be achieved by: 1) using standard techniques to collect and analyze representative samples and by reporting analytical results in appropriate units; and 2) comparing past and future results.

Completeness. Measurement of completeness (C) can be defined as the ratio of acceptable (non-rejected) measurements obtained to the total number of measurements for an activity. Completeness can be defined as:

$$C = \frac{\text{(Number of acceptable data points) x100}}{\text{(Total number of data points)}}$$

Sensitivity. As used in this context, sensitivity refers to the ability of project analytical procedures to identify and quantify target analytes at concentrations low enough to meet project data needs. Specific indicators of sensitivity in analytical measurements include the method detection limit (MDL), method reporting limit (MRL), and the sample-reporting limit (SRL).

The MDL is a purely statistical value, which is defined by EPA as the concentration at which an analytical system has a 99 percent probability of avoiding false positive results, and is determined by preparation and analysis of a minimum of seven replicate portions of a low-level standard.

The MDL lies in a region of high quantitative uncertainty, and results near the MDL must be considered as estimates.

The MRL is normally set at a factor of 5 to 10 times the MDL. The exact number depends on the lowest concentration that a laboratory can successfully use as a low calibration standard. The MRL is considered the lowest concentration that a lab can report with reasonable quantitative accuracy, although results less than 5 times the MRL can still be highly variable.

The SRL represents the lowest concentration of an analyte that can be reported with reasonable quantitative accuracy in a particular sample. The SRL is typically represented as the MRL multiplied by a dilution factor.

The sensitivity of the analytical methods (i.e., method reporting limits) identified for this project are sufficient to allow comparison of project results to decision criteria from the DEQ risk-based concentrations (RBC) tables. Analytical MRLs for all requested analytes are listed in the work plan.

Selectivity. Selectivity is the ability of an analytical procedure to accurately identify an analyte, and to distinguish that analyte from interferences. In order to ensure that project data needs are met, any subcontract laboratories will follow method requirements, including second column or GC/MSD confirmation for organic compounds, and will discuss compound identification issues with ERM if they are identified.

2.1.5 Documents and Records

Records will be maintained, document the activities and data related to the field sampling, laboratory analysis, and the results of the data verification and validation. These records will be archived in the project file. The sampling results will also be stored in the project database, maintained by ERM.

All documents pertaining to this project will be filed in the ERM office or archive. Project files will include correspondence, final reports, field notes, laboratory results, etc. The files will be maintained by ERM for at least 5 years.

2.1.5.1 *Field Documentation*

Field logbooks will be the main source of field documentation for all field activities. Notes will be taken in indelible, blue or black ink. The front and inside of each field logbook will be marked with the project name, number, and logbook number. The field logbooks or copies of the field notes will be stored in the project files when not in use and upon completion of each sampling event.

The first entry at the beginning of each day will state the date and time, project number, names of all field personnel on site (including subcontractors and the company for which they work), weather conditions, and the purpose of fieldwork. Each subsequent page will be started with the project number and the date. The bottom of each page will have the date and the initials of all personnel entering information onto that page. Any remaining unused lines will be crossed through. Errors will not be erased. All errors will have a single strikethrough with an initial and date next to the strikethrough and the subsequent change made. At the end of each day, the field staff will sign the field logbook.

Information specific to each stormwater sampling location will be recorded during sampling in the logbook. Information recorded on the FSDS may include, but will not be limited to:

- Sampling location identification;
- Weather conditions;
- Surrounding site activities;
- Date and time of sampling for each field sample and QA/QC sample;
- Sample identification or naming system, including each unique sample name/number;
- Volume of sample collected by number and type of sample containers;
- Sample preservation techniques and analyses requested; and
- Information relevant to quality control (e.g., sampling discrepancies or difficulties, unexpected conditions, abnormal sampling procedures).

Once the sample has been collected, the sample will entered onto the chain of custody (COC) forms. These forms are used to document the custody of the samples from the field until receipt at the laboratory. Upon receipt at the laboratory, the samples will be checked for physical integrity and logged into the laboratory sample tracking system. The COC forms and the sample receipt forms will be included in the laboratory data report package. Any discrepancies in the physical conditions of the samples or breaks in the chain of custody will be reported within 24 hours of sample receipt.

2.1.5.2 *Laboratory Documentation*

It is not anticipated that full validation of raw data will be required for samples collected in support of this project. Laboratory documentation and data deliverables will therefore not include raw data, but will include sufficient detail to assess data quality. Specific documentation to be included in the laboratory data packages includes:

- A case narrative that describes any problems encountered by the lab during analysis of project samples and results limitations in data usability;
- A cross-reference between laboratory sample IDs and project sample names;
- Summaries of analytical results for project samples, including method detection limits, method reporting limits or sample quantification limits, preparation and analytical method used, identification of any dilution performed, and footnotes to indicate any data usability limitations;
- Summaries of quality control results associated with the project samples including laboratory blank results, blank and matrix spike recoveries, duplicate analysis results, and surrogate recoveries where applicable;
- Summaries of reporting requirements for ICP-MS instrument tuning, internal standard recoveries, results of interference check samples, or results of serial dilution when laboratory QC data is outside acceptance criteria; and
- Copies of the COC forms and laboratory sample receipt forms.

2.1.5.3 *Quality Documentation*

Data verification and validation will be performed by ERM. Data validation will include reviewing the laboratory documentation, results of quality control samples, assessment of data completeness, comparison to the data quality objectives, and an assessment of the overall quality of the data, including qualifiers and limitations on the use of the data. A data validation report will be prepared by ERM and included in the final report.

3.0 DATA ACQUISITION

The work plan describes the rationale and approach that will be used to evaluate stormwater as a source of contamination to the Portland Harbor. Stormwater and sediment samples will be collected to determine if the storm sewer system is a pathway of contaminants of interest (COIs) by comparing the results to the Joint Source Control Screening (JSCS) criteria. The results of this assessment will be used to determine appropriate Best Management Practices (BMPs), future monitoring requirements, and IRMs, as required.

3.1 SAMPLING PROCESS DESIGN

A combination of stormwater grab and sediment samples will be collected from locations across the site. The objective is to collect samples from locations that are representative of the stormwater entering the storm sewer system from the various activities across the site. The stormwater and sediment samples from each location will be analyzed for the chemical constituents listed in the work plan.

3.1.1 Sampling Methods and Handling

The methods used to collect stormwater, catch basin solids, and surface wipe samples are detailed in the work plan. The equipment and techniques used depend on the physical conditions of each location and the type of sampling specified. Standard operating procedures (SOPs) are given in the appendices of the work plan.

All the containers will have screw type lids, with Teflon® inserts to prevent a reaction with the plastic sample lid. If required, preservatives will be added to the jars at the laboratory.

The sample jars used will be commercially available, pre-cleaned jars. The laboratory will maintain shipping and certification records from the supplier to trace the bottles back to the respective bottle rinse blank results. The bottle documentation supplied by the laboratory will be included in the ERM project file.

The laboratory will not dispose of the samples until authorized by Univar. The laboratory will appropriately dispose of the samples based on the matrix and analytical results. If the samples are determined to be hazardous, the remaining material will be disposed of through the appropriate laboratory waste handling procedures.

3.2 ANALYTICAL METHOD REQUIREMENTS

Analytical methods used will be appropriate for the intended use of the data as described in this QAPP. Analytical methods will include EPA-approved methods specified in SW-846 that comply with MRLs specified in the Portland Harbor Joint Source Control Strategy (DEQ and EPA 2005). Adherence to the relevant preparation and extraction, analytical and reporting methods will be evaluated during the data review. The analytical methods for individual analytes are summarized in the work plan.

3.3 QUALITY CONTROL

Quality control (QC) samples will be prepared in the field and in the laboratory to assess the bias and precision of the field and laboratory methods.

3.3.1 Field Quality Control

Field QC samples will be collected at a frequency of one set of QC samples per field event. Field QC samples will consist of field duplicates, MS/MSD, and equipment rinsate blanks (when non-disposable sampling equipment is used).

Field duplicates are replicate samples collected at the same location during the same sampling session and at the same time. Due to sample volume requirements, field duplicates will be collected at a grab sample or sediment sample location. Field duplicate samples are submitted to the contract laboratory. Field duplicates provide an indication of the reproducibility of the sampling and analysis procedures for a given sample matrix, including heterogeneity of the sample itself. The field duplicates will be collected in the same container types and handled and analyzed in the same manner as all other samples.

Laboratory QC samples are field samples that are designated for laboratory QC procedures such as matrix spike analysis. Extra volume must be collected for laboratory QC samples in containers provided by the laboratory, so that the laboratory has sufficient volume to perform all required analyses.

Equipment rinsate blanks are samples designed to assess the potential for cross-contamination after equipment decontamination. These samples are collected from the final de-ionized water rinse, following equipment decontamination. The equipment rinsate blank sample is collected in a full suite of sample containers and the sample is analyzed for the same suite of compounds as the investigative samples. Equipment rinsate blanks will only be collected when non-disposable sampling equipment is used.

3.3.2 Laboratory Quality Control

The detailed requirements for the laboratory QC procedures are given in the EPA method protocols that have been referenced. These requirements also include control limits and corrective actions. The laboratory will adhere to the QC procedures in the method protocols and this QAPP. Laboratory QC samples will include method blanks, matrix spike, matrix spike duplicates, and surrogates. The frequency of laboratory QC samples will be one every twenty samples, with a minimum of one per extraction batch.

The control limits, or method quality objectives, for the applicable recoveries and relative percent differences have been established by the laboratory as required by EPA SW846 methods. These criteria will be used by the laboratory to determine the acceptability of the data.

3.4 EQUIPMENT CALIBRATION PROCEDURES

All analytical instruments shall be calibrated using traceable standards in accordance with the specified analytical methods and manufacturers' procedures. Calibration procedures, at a minimum, will consist of an initial calibration, assessment of a detection limit standard, analysis of calibration blanks, and, as appropriate, analysis of interference check samples.

Laboratory instruments and measurement equipment will be calibrated in accordance with manufacturer's instructions and the analytical laboratory's quality assurance plans (QAP) presented in Appendix A.

Records of standard preparation and instrument calibration data shall be maintained. Instrument calibration shall include daily checks using material prepared independently of the calibration standards; instrument response shall be evaluated against established criteria. The analysis logbook, maintained for each analytical instrument, shall include, at a minimum, the date and time of calibration, the initials of the personnel performing the calibrations, the calibrator reference number and concentration the equipment was calibrated against.

3.5 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The quality of the supplies and consumables used during sample collection and analysis can affect the quality of the data. Equipment should be cleaned so that there is no detectable contamination introduced to the samples or extracts.

The laboratory will provide cleaned and documented sample containers. The containers will be visually inspection prior to use. Any suspect containers will be discarded.

Solvents used in equipment decontamination will have documented purity, and the containers will be initialed and dated when opened. The quality of de-ionized water used for decontamination and equipment blanks will be documented. If the laboratory provides de-ionized water, the laboratory will document the quality. De-ionized water that is not sourced from the laboratory will require a de-ionized water blank sample to be collected.

Reagents and calibration standards of appropriate purity, and suitably cleaned equipment will be used during the laboratory analysis. The acceptance criteria for the laboratory supplies and equipment are detailed in the laboratory SOPs and QAP. The documentation and certifications for field supplies and equipment will be retained by ERM, whereas the documentation and certifications for laboratory supplies and equipment will be retained by the laboratory.

3.6 DATA MANAGEMENT

Data for this project will be generated in the field and the laboratory, then reviewed for acceptability, and entered in the project database. Data manipulations, such as unit conversions and corrections, will be recorded in the database change log.

3.6.1 *Field Data*

Data generated in the field will include field logbook entries, location identifications, sample dates, field parameter measurements, observations, and additional information (such as field duplicate number). These data will be manually entered into an electronic format, and then checked by a second person, before final inclusion in the database.

3.6.2 *Laboratory Data*

Data generated by the subcontract laboratories will undergo data reduction and review procedures described in the laboratory QAP and SOPs. Data generated, reduced, and reviewed by the laboratories will undergo a comprehensive data review under the direction of the laboratory QA Officer or designee.

Laboratory analytical data are first generated in raw form at the instrument. These data may be in either graphic form or printed tabular form. Specific data reduction, generation procedures, and calculations are found in each of the methods, as well as within the laboratory QAP and SOPs.

3.6.2.1 *Laboratory Data Reduction*

The laboratory will perform in-house analytical data reduction under the direction of the laboratory QA Officer or designee. Laboratory reduction procedures will be those adopted, where appropriate, from SW-846 (EPA 1986) and those described in the laboratory QAP. The data reduction steps will be documented, signed, and dated by the analyst or designee. Data reduction will be conducted as follows:

- Raw data produced by the analyst will be processed and reviewed for attainment of QC criteria as outlined in this document and/or established EPA methods for overall reasonableness and for calculation or transcription errors.
- Data will then be entered into the Laboratory Information Management System (LIMS) and a computerized report will be generated and sent to the laboratory QA Officer or designee for review.
- Laboratory qualifiers as described and defined in the laboratory QAPs will include, but are not limited to:
    - Concentrations below required reporting limits.

- Estimated concentrations due to poor spike recovery.
- Concentrations of the chemical also found in the laboratory blank.
- Other sample-specific qualifiers necessary to describe QC conditions.

The laboratory will maintain detailed procedures for laboratory record keeping to support the validity of all analytical work. Each data report package submitted to Univar will contain the laboratory's written certification that the requested analytical method was run and that all QA/QC checks were performed. The laboratory program administrator will provide QC reports of their external audits, if appropriate, which will become part of the project files.

Data obtained from laboratory analysis are reduced in accordance with procedures outlined in the laboratory QAP. Unless otherwise specified, all data will be calculated and reported in units consistent with other organizations reporting similar type data to allow comparability of databases among organizations. Data will be reported in milligrams per liter (mg/L) or micrograms per liter (µg/L) for water and milligrams per kilogram (mg/kg) or micrograms/kilogram (µg/kg) for sediment.

3.6.2.2 *Laboratory Data Review*

This review process involves evaluation of both the results of the QC data and the professional judgment of the person(s) conducting the review. This application of technical knowledge and experience to the evaluation of data is essential in ensuring that high quality data are generated. Each subcontract laboratory has documented procedures, which are to be followed and must be accessible to all laboratory personnel.

The laboratory QA Officer or designee will evaluate the quality of the work based on this document and an established set of laboratory guidelines to ensure the following:

- Sample preparation information is correct and complete;
- Analysis information is correct and complete;
- Appropriate procedures have been followed;
- Analytical results are correct and complete;
- Laboratory QC check results are within appropriate QC limits;

- Special sample preparation and analytical requirements have been met;
- Documentation is complete (all anomalies in the preparation and analysis have been documented; holding times are documented); and
- Laboratory qualifiers have been assigned to all samples with data usability limitations.

3.6.2.3 Laboratory Data Deliverables

Upon acceptance of the data by the laboratory QA Officer, or designee, deliverables will be generated and submitted to the ERM project manager. Each data report package submitted will contain the laboratory's written certification that the requested analytical method was run and that all laboratory QC checks were performed. The laboratory program administrator will provide the QC reports of their external audits, if appropriate, which will become part of the project files.

Along with a hardcopy of the results, the laboratory data (including QC sample results) will also be reported as an electronic data deliverable (EDD) suitable for import to the project database.

4.0 *ASSESSMENT AND OVERSIGHT*

ERM will be fundamentally responsible for the monitoring of field and sampling activities in order to maintain an appropriate level of sample QA. This project has a limited scope and only involves a small number of project team members. The ERM project and task managers will stay in close verbal communication with the field sampling team and the laboratory. Due to the size of this project, few scheduled assessment activities are planned.

4.1.1 *Assessments and Response Actions*

The planned assessment activities the project team will perform include readiness reviews prior to sampling and prior to the release of final results to data users. Internal reviews will be on going throughout the implementation of the project. No reports will be generated from the readiness reviews. Corrections to the database, based on reviews, will be tracked through the database change log.

Pre-sampling preparation includes organizational and procedural planning before the actual sampling takes place. Team members will understand their specific role and the roles of the other team members so that the sampling event reflects a coordinated effort. Each team member will understand the proper equipment and procedures to be used, the schedule of sampling events, the sequence of activities during any given event, and the health and safety procedures for the project. The project manager will verify that all field equipment is ready to be used at the site, that appropriate subcontractors have been contracted, scheduled and briefed (including a project specific health and safety briefing). Any deficiencies noted during this review will be corrected prior to commencing fieldwork.

A second readiness review will be conducted prior to the release of final data to the users. The data manager will verify that all analytical data have been received from the laboratory, that data validation and quality assessment have been completed, and appropriate data qualifiers have been entered into the database. The data manager or QA manager will correct deficiencies found during this review. Data users will be notified when the data are ready for distribution.

Review of work products will be conducted through this project to ensure that all phases of work follow the QA procedures in this QAPP. Issues that arise during the project can usually be resolved between the reviewer and the person generating the work product. Any problems that cannot be easily resolved will be brought to the attention of ERM Project Manager. The DEQ will be notified of any problems that may affect the outcome of the project.

It is the responsibility of every team member to report non-conformances to the ERM project manager, the laboratory QA manager, or the laboratory project manager as applicable. The project manager will ensure that the non-conforming data are not used until the non-conformance is corrected.

If serious problems are encountered during the sampling and analysis, a technical system audit may be required. The ERM QA manager or the laboratory QA manager would conduct the audit. The audits may examine any phase of the field-sampling, laboratory, or data management activities related to the project. The results of audits will be included in the laboratory data summary report.

4.1.2 Reports to Management

Deviations from methods or QA requirements described in this QAPP and the related work plan will be corrected immediately if possible. The ERM project manager will be notified, and assist in the resolving the issue if needed. It is not anticipated that a formal corrective action plan will be required. However, non-conformances that affect the quality of the data, or result in a change in scope, will be noted in the field logbook. This documentation will serve as the Corrective Action Report. The data summary report will include a description of the non-conforming issue, any attempted resolutions, and any effect on the quality and usability of the data.

Non-conformances discovered in the laboratory will be reported and resolved through the procedures detailed in the laboratory QAP and the appropriate method protocols. Laboratory non-conformances and the effects on data quality will be described in the data summary report.

5.0 DATA VALIDATION AND USABILITY

The field and laboratory data will be verified and validated according to the procedures and criteria described in this section. Data review and assessment for this project will follow guidance from EPA and will be conducted under the supervision of the ERM QA manager or other qualified chemist. The quality and usability of the data will be evaluated and discussed in the data summary report.

5.1 DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS

The field and laboratory data generated during this project will be verified and validated using the data quality review (DQR) process. Errors that are found during verification of the field data, laboratory data, and database entries will be corrected prior to the distribution of the final data.

The DQR will consist of evaluation of the DQIs discussed above against the project specific goals. Basic principles for the DQR will follow the current USEPA functional guidelines for data review, modified to account for use of SW-846 methods and project DQOs. The ERM QA Manager will perform the DQR, and results of the DQR will be routed to the ERM Project Manager for evaluation and action.

The ERM QA Manager will review data reports and field data before data are used in an application or incorporated into a technical report. All analytical data will be reviewed by the laboratory to ensure that data are technically valid, defensible, and in general compliance with DQOs. Sample matrix effects will be evaluated and data will be appropriately identified, qualified, or disregarded. Qualified data, as identified by the laboratory or Project Manager will be so noted on the database and these data, as appropriate, may be excluded from certain project applications.

All tabular and graphical data representations will be reviewed to ensure that information is accurately portrayed. The ERM Project Manager will review all deliverable work products in order to ensure that all findings and conclusions are based upon correct and accurate data. All reports will be prepared to ensure compliance with stipulated regulatory requirements and agency expectations. In situations that require review and evaluation of historic data, the limitations of reliance and the objectives of incorporation in the presentation will be clearly stated.

5.2 *VERIFICATION AND VALIDATION METHODS*

Field data will be verified during sample preparation and COC documentation, as well as at the completion of the field effort. The field data entries in the database will also be verified, and any errors corrected.

The procedures for verifying and validating laboratory data are detailed in the EPA functional guidelines and summarized in previous sections.

If a significant problem that affects data usability is discovered, the QA manager and project manager will contact the lab to initiate corrective action. If necessary, review of raw data associated with the identified problem will be performed. This further review will focus only on the identified problem, and will not include any analyses that did not exhibit serious deficiencies for an important target analyte.

Explanations of results outside of control limits and corrective actions taken by the laboratory will be described in the case narrative. The laboratory performs a data completeness check and verification as part of the preparation of the EDD. Data entries (including qualifier entries) in the database will be verified against hardcopies. Any errors will be corrected before final release of the data.

5.3 *RECONCILIATION WITH USER REQUIREMENTS*

The purpose of data validation is to determine the quality of the data gathered for each point. Data is evaluated against performance-based control limits. Non-conforming data may be either qualified or rejected. Rejected data will not be used.

As described in the EPA functional guidelines for data review non-conforming data may be qualified. The data qualifiers used for this project will be taken from the EPA function guidelines for data review, and will include:

U - The analyte was not detected above the method detection limit or quantitation limit.

J - The analyte was positively identified, but the associated concentration is an estimate.

UJ - The analyte was not detected above the stated quantitation limit, but the quantitation limit is an estimate, and may or may not represent the actual limit of quantitation needed to accurately measure the analyte in the sample.

N - Presumptive evidence of analyte presence was detected, but not all identification criteria were met. The presence of the analyte and the associated numerical concentration are both uncertain.

R - Results for the analyte are unusable due to serious deficiencies in the sample analysis. The presence or absence of the analyte cannot be verified.

Limitations on data use that are found during validation will be discussed in the data summary report. Data users will be informed on the limitations of the data and the potential effect on data interpretation and analysis.

6.0 REFERENCES

DEQ and USEPA. 2005. Portland Harbor Joint Source Control Strategy, Final, December 2005. Revision, July 2007. Oregon Department of Environmental Quality and U.S. Environmental Protection Agency, Portland, Oregon.

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USEPA. 2002a. EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5 EPA, EPA/240/R-02/009). U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

USEPA, 1999. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. (EPA-540/R-99-008). U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C

USEPA, 2002c. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. (EPA-540/R-99-008). U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

Table

Table 1

Project Team Contact Information
Quality Assurance Project Plan
Univar USA Inc.

Company	Name	Project Role	Phone	Email
EPA	Laura Castrilli	RCRA Project Coordinator	(206) 553-4323	castrilli.laura@epa.gov
Univar	Steven Roach	Director, Remediation	(419) 571-7410	steven.roach@univer.com
ERM	Dave Edwards	Partner	(425) 214-0452	dave.edwards@erm.com
ERM	Brendan Robinson	Project Manager	(503) 488-5282	brendan.robinson@erm.com
ERM	Rachel James	Project QA Coordinator	(907) 632-6292	rachel.james@erm.com
ALS Environmental	Howard Moorse	Project Manager	(360) 430-7733	Howard.Boorse@alsglobal.com

Notes:

EPA - United States Environmental Protection Agency

Appendix A
ALS Environmental Quality Assurance Plan

QUALITY ASSURANCE MANUAL

ALS ENVIRONMENTAL - KELSO FACILITY
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KELSO, WA 98626
360-577-7222 (TEL)
360-636-1068 (FAX)
WWW.ALSGLOBAL.COM

Doc ID:	ALKLS-QAM	Rev. Number:	26.1	Effective Date:	07/01/2018

Approved By:	General Manager - Ambrose Hughey	Date:	6/25/18
Approved By:	QA Manager - Carl Degner	Date:	6/22/18
Approved By:	Metals/Inorganics Manager - Jeff Coronado	Date:	6/22/18
Approved By:	Organics Manager - Todd Poyfair	Date:	6/22/18
Approved By:	Client Services Manager - Les Kennedy	Date:	6/22/18

Archival Date:	__________	Doc Control ID#:	___________	Editor:	___________

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Current Data Quality Objectives (DQOs) may be requested from the laboratory for specified methods or projects.

QA MANUAL CROSS REFERENCE TABLE

ALS QA Manual	ISO 17025:2005 Section	TNI Standard 2009 Volume 1, Module 2 Section
2	4.1	4.1
3	4.2	4.2
4	4.3	4.3
5	4.4	4.4
6	4.5	4.5
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21	5.10	5.10

1) Introduction and Scope

ALS Environmental, Kelso is a professional analytical services laboratory which performs chemical and microbiological analyses on a wide variety of sample matrices, including drinking water, groundwater, surface water, wastewater, soil, sludge, sediment, tissue, industrial and hazardous waste, air, and other material.

We recognize that quality assurance requires a commitment to quality by everyone in the organization - individually, within each operating unit, and throughout the entire laboratory. Laboratory management is committed to ensuring the effectiveness of its quality systems and to ensure that all tests are carried out in accordance to customer requirements. Key elements of this commitment are set forth in the SOP *Laboratory Ethics and Data Integrity* (CE-GEN001) and in this Quality Assurance Manual. ALS - Kelso is committed to operate in accordance with these requirements and those of regulatory agencies, accrediting authorities, and certifying organizations. The laboratory also strives for improvement through varying continuous improvement initiatives and projects.

Quality Management Systems are established, implemented and maintained by management. Policies and procedures are established in order to meet requirements of accreditation bodies and applicable programs, such as the Department of Defense (DOD) Environmental Laboratory Accreditation Program, as well as client's quality objectives. Systems are designed so that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. Quality Systems are applicable to all fields of testing in which the laboratory in involved.

Quality Control (QC) procedures are used to continually assess performance of the laboratory and quality systems. The laboratory maintains control of analytical results by adhering to written standard operating procedures (SOPs), using analytical control parameters with all analyses, and by observing sample custody requirements. All analytical results are calculated and reported in units consistent with project specifications to allow comparability of data.

This QAM is applicable to the facility listed on the title page. The information in this manual has been organized according to requirements found in the National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Standards (2003 and 2009), the EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, USEPA, 2001; General Requirements for the Competence of Testing and Calibration Laboratories, ISO/IEC 17025:2005, and the ALS Quality Management System Summary (QMS01). A glossary of pertinent terms and acronyms is included in Appendix A.

2) Organization

The ALS Environmental, Kelso staff, consisting of approximately 95 employees, includes chemists, technicians and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that the laboratory requires. During seasonal workload increases, additional temporary employees may be hired to perform specific tasks. All employees share the responsibility for maintaining and improving the quality of our analytical services.

ALS – Kelso is legally identifiable as ALS Group USA, Corp., dba ALS Environmental. ALS Group USA, Corp. is a component of ALS Limited, a publicly held Australian company. The ALS global website may be referred to for corporate ownership information (www.alsglobal.com/Our-Company). The laboratory is divided into operational and managerial units based upon specific disciplines. Each department is responsible for establishing, maintaining and documenting QA and QC practices meeting laboratory needs. Organizational charts of the laboratory, as well as the resumes of these key personnel, can be found in Appendix B. This laboratory organization is designed so that potential conflict of interest is avoided, and such that an adequate amount of supervisory personnel are in place to provide oversight and supervision of day to day operations.

3) Management

The purpose of the QA program at ALS Environmental, Kelso is to ensure that our clients are provided with analytical data that is scientifically sound, legally defensible, and of known and documented quality. The concept of Quality Assurance can be extended, and is expressed in the mission statement:

> "The mission of ALS Environmental, Kelso is to provide high quality, cost-effective, and timely professional testing services to our customers. We recognize that our success as a company is based on our ability to maintain customer satisfaction. To do this requires constant attention to customer needs, maintenance of state-of-the-art testing capabilities and successful management of our most important asset - our people - in a way that encourages professional growth, personal development and company commitment."

3.1 Quality Management Systems

In support of this mission, the laboratory has developed a Quality Management System to ensure all products and services meet our client's needs. The system is implemented and maintained by the Quality Assurance Manager with corporate oversight by the Quality Improvement Manager, USA. These systems are based upon ISO 17025:2005 standards, upon which fundamental programs (NELAC 2003, 2009 and DoD QSM) are based. Implementation and documentation against these standards are communicated in corporate policy statements, this QAM, and SOPs. Actual procedures, actions and documentation are defined in both administrative and technical SOPs. Quality systems include:

- Accreditation and certification program compliance
- Standard Operating Procedures
- Sample management and Chain of Custody procedures
- Document control
- Demonstration of Capability
- Analytical traceability
- Ethics training and data integrity processes
- Corrective action procedures
- Statistical control charting
- Management reviews

The effectiveness of the quality system is assessed in several ways, including:

- Internal and external audits
- Periodic reports to management
- Analysis of customer feedback
- Proficiency testing

The responsibilities of key positions within the laboratory are described below. Table 3-1 lists the ALS - Kelso personnel assigned to these key positions. Managerial staff members are provided the authority and resources needed to perform their duties. In the event that work is stopped in response to quality problems, as described below, only the Laboratory Director or Quality Assurance Manager has the authority to resume work.

Laboratory Director/General Manager (LD/GM) – The role of the Laboratory Director/General Manager is to provide operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. The LD/GM provides leadership and support for the QA program and is responsible for overall laboratory efficiency and financial performance. The LD/GM has the authority to stop work in response to quality problems. The LD/GM also provides resources for implementation of the QA program, reviews and approves this QA Manual, reviews and approves standard operating procedures (SOPs), and provides support for business development by identifying and developing new markets through continuing support of the management of existing client activities.

Quality Assurance Manager (QAM) – The Quality Assurance Manager has the authority and responsibility for implementing, maintaining, and improving the quality system. This includes coordination of QA activities in the laboratory, ensuring that personnel understand the quality system, ensuring communication takes place in the laboratory regarding implementation of the quality system, ensuring adequate staff training, and monitoring overall quality system compliance. The QAM continually evaluates potential improvements in the quality system. Audit and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews are used to support quality system implementation. The QAM is responsible for ensuring compliance with all applicable regulatory compliance quality standards (i.e. NELAP/TNI, ISO, DoD QSM, etc.). The QAM works with laboratory staff to establish effective quality control and assessment processes and has the authority to stop work in response to quality problems. The QAM is responsible for maintaining the laboratory's certifications and approvals, for maintaining the QA Manual and performing an annual review of it, reviewing and approving SOPs and ensuring the annual review of technical SOPs, maintaining QA records (metrological records, archived logbooks, PT results, etc.), document control, conducting proficiency testing studies, approving nonconformity and corrective action reports, and performing internal QA audits.

The QAM reports directly to the Laboratory Director and reports indirectly to the ALS Quality Improvement Manager, USA. It is important to note that when evaluating data, the QAM does so in an objective manner and free of outside, or managerial, influence.

The Quality Improvement Manager, USA is responsible for the overall QA program at all the ALS Environmental Group laboratories. The Quality Improvement Manager, USA is responsible for oversight of the QAM's regulatory compliance efforts (NELAP, ISO, DOD, etc.) and may perform internal audits to evaluate compliance. The Quality Improvement Manager, USA provides assistance to the laboratory QA staff and laboratory managers as necessary.

Deputy Laboratory Director and QA Manager – In the case of extended absence of the Laboratory Director or QAM, deputies are assigned to act in that role. Default deputies for these positions are the Client Services Manager or Metals Department Manager (for the Laboratory Director) and the Laboratory Director (for the QAM).

Environmental Health and Safety (EH&S) Officer – The EH&S officer is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections. The EH&S officer is also designated as the Chemical Hygiene Officer. The EH&S Officer has a dotted-line reporting responsibility to the ALS North America EH&S Manager.

Client Services Manager (CSM) – The CSM is responsible for the Client Services Department defined for the laboratory. This includes management and oversight of Project Managers, electronic deliverables, and support functions. The Client Services Department provides a complete interface with clients from initial project specification to final deliverables. The Client Services Manager has the responsibility and authority to stop work in response to accreditation/certification or quality problems, or in response to similar subcontractor quality problems. In the event of an extended absence, the CSM is to have an appointed deputy that is capable of assuming the role of the CSM.

Department Managers and Supervisors – Each manager or supervisor has the responsibility to ensure that QA and QC functions are carried out as specified when executing the analyses and related tasks and to ensure the production of high quality data. Managers and bench-level supervisors monitor the day-to-day operations to ensure that productivity and data quality objectives are met. A department manager has the authority to stop work in response to quality problems in their area. Managers and supervisors are responsible for ensuring that analysts perform testing according to applied methods, SOPs, and QC guidelines particular to the laboratory department. In the event of an extended absence, Department Managers are to have an appointed deputy meeting the qualifications specified in the appropriate standards to fill their role in the event of an extended absence.

Sample Management Office (SMO) – The Sample Management Office plays a key role in the laboratory QA program by handling all activities associated with receiving, storage, and disposal of samples, and maintaining documentation for all samples received. SMO staff is also responsible for the proper disposal of samples after analysis. The CSM oversees SMO and bottle preparation functions.

Information Technology (IT) – IT staff is responsible for the administration of the Laboratory Information Management System (LIMS) and other necessary support services. Other functions of the IT staff include laboratory network maintenance, IT systems development and implementation, education of analytical staff in the use of scientific software, Electronic Data Deliverable (EDD) support, and data back-up, archival and integrity operations.

3.2 Ethics, Professional Conduct and Data Integrity

One of the most important aspects of the success of ALS - Kelso is the emphasis placed on the integrity of the data provided and the services rendered. This success is reliant on both the professional conduct of all employees within ALS - Kelso as well as established laboratory practices. All personnel involved with environmental testing and calibration activities must familiarize themselves with the quality documentation and implement the policies and procedures in their work.

All employees are required to sign and adhere to the requirements set forth in the *ALS Code of Conduct Policy* and agree to the *Confidentiality Agreement (*Appendix C).

3.2.1 Professional Conduct

To promote quality ALS - Kelso requires certain standards of conduct and ethical performance among employees. The following examples of documented ALS policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action.
- Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.
- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible.

3.2.2 Confidentiality

It is the responsibility of all laboratory employees to safeguard sensitive company information, client data, records, and information; and matters of national security concern should they arise. The nature of our business and the well-being of our company and of our clients is dependent upon protecting and maintaining confidential and/or proprietary company and client information. All information, data, and reports (except that in the public domain) collected or assembled on behalf of a client is treated as confidential.

Information may not be given to third parties without the consent of the client. Unauthorized release of confidential information about the company or its clients is taken seriously and is subject to formal disciplinary action. All employees sign a confidentiality agreement upon hire to protect the company and client's confidentiality and proprietary rights.

3.2.3 Prevention and Detection of Improper, Unethical or Illegal Actions

It is the intention of ALS - Kelso to proactively prevent and/or detect any improper, unethical or illegal action conducted within the laboratory. This is performed by the implementation of a program designed for not only the detection but also prevention. Prevention consists of educating all laboratory personnel in their roles and duties as employees, company policies, inappropriate practices, and their corresponding implications as described here.

In addition to education, appropriate and inappropriate practices are included in SOPs such as manual integration, data review and specific method procedures. Electronic and hardcopy data audits are performed regularly, including periodic audits of chromatographic electronic data. Requirements for internal QA audits are described in the SOP *Internal Audits* (CE-QA001). All aspects of this program are documented and retained on file according to the company policy on record retention.

The ALS Employee Handbook also contains information on the ALS ethics and data integrity program, including mechanisms for reporting and seeking advice on ethical decisions.

3.2.4 Laboratory Data Integrity, Ethics, and Computer Security Training

Each employee receives data integrity and ethics training on an annual basis. The topics covered and training participation are documented. It is the responsibility of the QAM to ensure that the training is conducted as described. Additionally, new employees are given a new employee QA and data integrity/ethics orientation within the first two month of hire, followed by the routine annual training.

Key topics covered are the organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting, record keeping, and reporting data integrity issues. Training includes discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedures. Training topics also cover examples of improper actions, legal and liability implications (company and personal), causes, prevention, awareness, and reporting options. Computer security is also included, covering ALS computing security awareness, passwords and access, and related topics.

Trainees are required to understand that any infraction of the laboratory data integrity procedures will result in an investigation that could lead to serious consequences including immediate termination, or civil/criminal prosecution.

3.2.5 Management and Employee Commitment

ALS - Kelso makes every attempt to ensure that employees are free from any commercial, financial, or other undue pressures that might affect their quality of work. Related policies are described in the ALS Employee Handbook. This includes:

- ALS Open Door Policy (ALS Employee Handbook) – Employees are encouraged to bring any work related problems or concerns to the attention of local management or their Human Resources representative. However, depending on the extent or sensitivity of the concern, employees are encouraged to directly contact any member of upper management.
- ALS Integrity Hotline – An anonymous and confidential reporting system available to all employees that is used to communicate misconduct and other concerns. The program shall help minimize negative morale, promote a positive work place, and encourage reporting suspected misconduct without retribution. Associated upper management is notified and the investigations are documented.
- Use of flexible work hours. Within reason and as approved by supervisors, employees are allowed flexible work hours in order to help ease schedule pressures which could impact decision-making and work quality.
- Operational and project scheduling assessments are continually made to ensure that project planning is performed and that adequate resources are available during anticipated periods of increased workloads. Procedures for subcontracting work are established, and within the ALS Environmental laboratory network additional capacity is typically available for subcontracting, if necessary.
- Gifts and Favors (ALS Employee Handbook) – To avoid possible conflict of interest implications, employees do not give unusual gifts or favors to, nor accept such gifts or favors from, persons outside the Company who are, or may be, in any way concerned with the projects on which the Company is professionally engaged.

Table 3-1
Summary of Technical Experience and Qualifications – Key Personnel

Personnel	Years of Experience	Project Role
Ambrose Hughey, B.S.	14	General Manager
Carl Degner, M.S.	34	Quality Assurance Manager
Les Kennedy, B.A.	26	Client Services Manager
Jeff Coronado, B.S.	29	Metals & Inorganics Department Manager
Todd Poyfair, B.S.	26	Organics Department & Extractions Manager
Eileen Arnold, B.A.	34	Environmental Health and Safety Officer
Joe Caulfield	17	Information Technology

4) Document Control

Procedures for control and maintenance of documents are described in SOP *Document Control* (CE-GEN005). The requirements of the SOP apply to all laboratory logbooks (standards, maintenance, run logbooks, etc.), certificates of analysis, SOPs, QAMs, quality assurance project plans (QAPPs), Environmental Health & Safety (EHS) manuals, and other controlled ALS Environmental documents.

Each controlled copy of a controlled document is released after a document control number is assigned and the recipient is recorded on a document distribution list. Filing and distribution is performed by the QAM, or designee, and ensure that only the most current version of the document is distributed and in use. A document control number is assigned to logbooks. Completed logbooks that are no longer in use are archived in a master logbook file. Logbook entries are standardized following SOP *Making Entries onto Analytical Records* (CE-QA007). The logbook entries are reviewed and approved at a regular interval (quarterly).

A records system is used which ensures all laboratory records (including raw data, reports, and supporting records) are retained and available. The archiving system is described in SOP *Data Archiving* (ADM-ARCH).

External documents relative to the management system are managed by the QAM. To prevent the use of invalid and/or outdated external documents, the laboratory maintains a master list of current documents and their availability. The list is reviewed before making the documents available. External documents are not issued to personnel.

5) Review of Requests, Tenders and Contracts

Requests for new work are reviewed prior to signing any contracts or otherwise agreeing to perform the work. The specific methods to be used are agreed upon between the laboratory and the client. A capability review is performed to determine if the laboratory has or needs to obtain certification to perform the work, to determine if the laboratory has the resources (personnel, equipment, materials, capacity, skills, expertise) to perform the work, and if the laboratory is able to meet the client's required reporting and QC limits. The results of this review are communicated to the client and any potential conflict, deficiency, lack of appropriate accreditation status, or concerns of the ability to complete the client's work are resolved. Any differences between the request or tender and the contract shall be resolved before any work commences. The client should be notified at this time if work is expected to be subcontracted. Each contract shall be acceptable both to the laboratory and the client. Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work. If a contract needs to be amended after work has commenced, the contract review process is repeated and any amendments are communicated to all affected personnel. Changes in accreditation status affecting ongoing projects must be reported to the client.

6) Subcontracting of Tests

Analytical services are subcontracted when the laboratory needs to balance workload or when the requested analyses are not performed by the laboratory. Subcontracting is only done with the knowledge and approval of the client and to qualified laboratories. Subcontracting to another ALS Environmental Group laboratory is preferred over external-laboratory subcontracting. Further, subcontracting is done using capable and qualified laboratories. Established procedures are used to qualify external subcontract laboratories. These procedures are described in SOP *Qualification of Subcontract Laboratories* (CE-QA004). The Quality Assurance staff is responsible for maintaining a list of qualified subcontract laboratories.

7) Purchasing Services and Supplies

The quality level of reagents and materials (grade, traceability, etc.) required is specified in analytical SOPs. Department supervisors ensure that the proper materials are purchased. Inspection and verification of material ordered is performed at the time of receipt by receiving personnel. The receiving staff labels the material with the date received. Expiration dates are assigned as appropriate for the material. Storage conditions and expiration dates are specified in the analytical SOP. *Quality of Reagents and Standards* (CE-QA012) and Reagent and *Standards Login and Tracking* (ADM-RLT) provides default expiration requirements. Supplies and services that are critical in maintaining the quality of laboratory testing are procured from pre-approved vendors. The policy and procedure for purchasing and procurement are described in SOP *Procurement and Control of Laboratory Services and Supplies* (CE-GEN007).

Receipt procedures include technical review of the purchase order/request to verify that what was received is identical to the item ordered. The laboratory checks new lots of reagents for unacceptable levels of contamination prior to use in sample preservation, sample preparation, and sample analysis by following SOP *Reagent and Standards Login and Tracking* (ADM-RLT).

8) Service to the Client

ALS - Kelso utilizes a number of processes to ensure that adequate resources exist to meet service demands. Senior staff meetings, tracking of outstanding proposals, and a current synopsis of incoming work all assist the senior staff in properly allocating sufficient resources. Status/production meetings are conducted regularly with the laboratory and Project Managers to inform the staff of the status of incoming work, future projects, or project requirements.

The Project Manager is a scientist assigned to each client to act as a technical liaison between the client and the laboratory. The Project Manager is responsible for ensuring that the analyses performed by the laboratory meet all project and contract requirements. This entails coordinating with the laboratory staff to ensure that client-specific needs are understood and that the services provided are properly executed and satisfy the requirements of the client.

Laboratory management also monitors a number of other indicators to assess the overall ability of the laboratory to successfully perform analyses for its clients. This includes on-time performance, customer complaints, training reports and non-conformity reports. A frequent assessment is made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload.

All Requests for Proposal (RFP) documents are reviewed by the Project Manager and appropriate managerial staff to identify any project specific requirements that differ from the standard practices of the laboratory. Any requirements that potentially cannot be met are noted and communicated to the client, as well as requesting the client to provide any applicable project specific Quality Assurance Project Plans (QAPPs).

When a client requests a modification to an SOP, policy, or standard specification the Project Manager will discuss the proposed deviation with the Client Services Manager, Laboratory Director, and department manager to obtain approval for the deviation. The QAM may also be involved. All project-specific requirements must be on-file and with the service request upon logging in the samples. The modification or deviation must be documented. A Project-Specific Communication Form, Form V, or similar, may be used to document such deviations.

The laboratory affords clients cooperation to clarify the client's request and to monitor the laboratory's performance in relation to the work performed, provided that the laboratory ensures confidentiality to other clients. The laboratory maintains and documents timely communication with the client for the purposes of seeking feedback and clarifying customer requests. Feedback is used and analyzed to improve the quality of services. The SOP *Handling Customer Feedback* (CE-GEN010) is in place for these events.

9) Complaints

In addition to project communication and internal communication of data issues, the laboratory also maintains a system for dealing with customer complaints. The procedure is described in SOP *Handling Customer Feedback* (CE-GEN010). The person who initially receives feedback in the form of a complaint (typically the Project Manager) is responsible for documenting the complaint. If the Project Manager is unable to satisfy the customer, the complaint is brought to the attention of the Client Services Manager, Laboratory Director, or QAM for final resolution. The complaint and resolution are documented.

10) Facilities and Equipment

The ALS Environmental Kelso laboratory features over 45,000 square feet of laboratory and administrative workspace. The laboratory has been designed and constructed to provide safeguards against cross-contamination of samples and is arranged according to work function, which enhances the efficiency of analytical operations. The ventilation system has been specially designed to meet the needs of the analyses performed in each work space. Also, ALS - Kelso minimizes laboratory contamination sources by employing janitorial and maintenance staff to ensure that good housekeeping and facilities maintenance are performed. In addition, the segregated laboratory areas are designed for safe and efficient handling of a variety of sample types. These specialized areas (and access restrictions) include:

- Shipping and Receiving
- Sample Management Office, including controlled-access sample storage areas
- Inorganic/Metals Sample Preparation Laboratories (2)
- Inorganic/Metals "clean room" sample preparation laboratory
- ICP-AES Laboratory
- ICP-MS Laboratory
- Low-level Mercury Laboratory
- Water Chemistry & General Chemistry Laboratories (3)
- Semi-volatile Organics Sample Preparation Laboratory
- Gas Chromatography and High Performance Liquid Chromatography Laboratories
- Gas Chromatography/Mass Spectrometry Laboratories (2)
- Semi-volatile Organics Drinking Water Laboratory
- Volatile Organics Laboratory
  - Separate sample preparation laboratory
  - Access by semi-volatile sample preparation staff only after removing lab coat and solvent-contaminated gloves, etc.
- Microbiology Laboratory
- Laboratory Deionized Water Systems (2)
- Laboratory Management, Client Service, Report Generation and Administration

- Data Archival, Data Review and support functions areas

In addition, the designated areas for sample receiving, refrigerated sample storage and dedicated sample container preparation and shipping areas provide for the efficient and safe handling of a variety of sample types. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. The equipment and instrumentation are appropriate for the procedures in use. Refer to Appendix D for a Laboratory Floor Plan and Appendix E for a list of major equipment, illustrating the laboratory's overall capabilities and depth.

11) Sample Management

11.1 Sampling and Sample Preservation

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. ALS - Kelso recommends that clients follow sampling guidelines described in 40 CFR 136, 40 CFR 141, USEPA SW 846, and state-specific sampling guidelines, if applicable. Sampling factors that must be taken into account to insure accurate, defensible analytical results include:

- Amount of sample taken
- Type of container used
- Type of sample preservation
- Sample storage time
- Proper custodial documentation

The laboratory uses the sample preservation, container, and holding-time recommendations published in a number of documents. The primary documents of reference are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III, IV for hazardous waste samples; USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, and Supplements; EPA 40CFR parts 136 and 141 and associated Method Update Rules; and Standard Methods for the Examination of Water and Wastewater for water and wastewater samples (see Section 23 for complete references). The container, preservation and holding time information for these references is summarized in Appendix F for soil, water, and drinking water. The current EPA CLP Statement of Work should be referred to for CLP procedures. Where allowed by project sampling and analysis protocols (such as Puget Sound Protocols) the holding time for sediment, soil, and tissue samples may be extended for a defined period when stored frozen at -20˚C.

ALS - Kelso provides clients with sample containers with applicable preservatives. Containers are purchased as pre-cleaned to a level 1 status, and conform to the requirements for samples established by the USEPA. Certificates of analysis for sample containers are available upon request. Reagent water used for sampling blanks (trip blanks, etc.) and chemical preservation reagents are tested by the laboratory to ensure that they are free of interferences and documented. Our sample kits typically consist of pre-cleaned, rinsed, and air-dried shipping coolers with foam liners, specially prepared and labeled sample containers individually wrapped in protective material (VOC vials are placed in a specially made foam holder), chain-of-custody (COC) forms, and custody seals. Container labels and custody seals are provided for each container. Figure 11-1 shows the chain-of-custody form routinely used at ALS - Kelso and included with sample kits. Gel ice is included upon request. For large sample container shipments the containers may be shipped in their original boxes. Such shipments will consist of labeled and preserved sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc.) for return to ALS, unless otherwise instructed by the client.

ALS - Kelso also provides courier service that makes regularly scheduled trips on the I-5 corridor between the greater Portland, Oregon area and the greater Seattle/Tacoma area, and nearby communities and facilities.

Returning shipping coolers are cleaned and decontaminated. If any such cooler exhibits an odor or other abnormality after receipt and cleaning, a more vigorous decontamination process is employed. Containers which cannot be decontaminated are discarded. ALS - Kelso keeps client-specific shipping requirements on file and utilizes major transportation carriers to necessary to meet sample shipping requirements (same-day, overnight, etc.).

When ALS - Kelso ships samples to other laboratories for analysis, similar sample integrity processes are used to ensure preservation and proper sample handling, and to avoid any possible breakage, cross-contamination of samples, or identification problems. Alternatively, the receiving laboratory's procedures may be specified. Chain of custody is maintained during the process.

11.2 Sample Receipt and Handling

Standard procedures are established for the receiving of samples into the laboratory and are found in SOP SMO-GEN, *Sample Receiving*. These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, is complete and consistent with the samples received.

Once samples are received or delivered to the laboratory the sample management office uses a Cooler Receipt and Preservation Check Form (CRF - Figure 11-2) is used to assess the shipping cooler and its contents as received by the laboratory. Any anomalies or discrepancies observed during the initial assessment are recorded on the CRF and COC documents. Verification of sample integrity includes the following activities:

- Assessment of custody seal presence/absence, location and signature;
- Temperature of sample containers upon receipt;
- Chain of custody documents properly used (entries in ink, signature present, etc.);
- Sample containers checked for integrity (broken, leaking, etc.);
- Sample is clearly marked and dated (bottle labels complete with required information);
- Appropriate containers (size, type) are received for the requested analyses;
- The minimum amount of sample material is provided for the analysis.
- Sample container labels and/or tags agree with chain of custody entries (identification, required analyses, etc.);
- Assessment of proper sample preservation (if inadequate, corrective action is employed); and
- VOC containers are inspected for the presence/absence of bubbles. (Assessment of proper preservation of VOC containers is performed by lab personnel).

Samples are logged into a Laboratory Information Management System (LIMS). Potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When the Project Manager and client have reached a satisfactory resolution, the login process may continue and analysis may begin. During the login process each sample container is given a unique laboratory code and a Service Request form is generated which contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates, analysis due dates and other pertinent information. The service request is reviewed by the applicable Project Manager for accuracy and completeness.

Samples are stored as per method requirements until analysis, unless otherwise specified, using various refrigerators, freezers, or designated secure areas. ALS - Kelso has multiple walk-in and refrigerator cold storage units which house the majority of samples, including dedicated refrigerated storage of VOC samples. The VOC storage units are monitored using storage blanks as described in SOP VOC-BLAN, *VOA Storage Blanks*. ALS - Kelso also has multiple sub-zero freezers capable of storing samples at -10 to -30°C primarily used for tissue and sediment samples. The temperature of each sample storage unit is monitored real time with an electronic temperature monitoring system.

ALS - Kelso adheres to the method-prescribed or project-specified holding times for all analyses. Analysts monitor holding times by obtaining analysis-specific reports from the LIMS. These reports provide holding time information on all samples for the analysis, calculated from the sampling date and the holding time requirement. To document holding time compliance, the date and time analyzed is printed or written on the analytical raw data. Unless other arrangements have been made in advance, aqueous samples are retained for 60 days from receipt, soil samples are retained for 60 days from receipt, and tissue samples are retained frozen for 90 days. Upon expiration of these time limits, the samples are either returned to the client, disposed of according to approved disposal practices, or archived. Sample extracts are retained as specified in analytical SOPs. All samples are characterized according to hazardous/non-hazardous waste criteria and are segregated accordingly. All hazardous waste samples are disposed of according to formal procedures outlined in the ALS Environmental Health and Safety Manual and in accordance with applicable laws. Documentation is maintained for each sample from initial receipt through final disposal to ensure that an accurate history of the sample from “cradle to grave” is available.

11.3 Sample Custody

Sample custody transfer at the time of sample receipt is documented using chain-of-custody (COC) forms accompanying the samples. During sample receipt, it is also noted if custody seals were present.

Facility security and access is important in maintaining the integrity of samples received at ALS - Kelso. Access to the laboratory facility is limited by use of locked exterior doors with a coded/card entry, except for the reception area and sample receiving doors, which are staffed during business hours and locked at all other times. In addition, the sample storage area within the laboratory is a controlled access area with locked doors with a coded entry. The facility is equipped with an alarm system and the laboratory employs a private security firm to provide nighttime and weekend security.

A barcoding system is used to document internal sample custody. The system uniquely identifies sample containers and provides an electronic record of the sample custody. Procedures are also defined for sample extracts, digestates, and leachates.

The procedures are described in the SOP SMO-SCOC, *Sample Tracking and Internal Chain of Custody*.

11.4 Project Setup

The analytical method(s) used for sample analysis are chosen based on the client's requirements. LIMS codes are chosen to identify the analysis method used for analysis. The Project Manager ensures that the correct methods are selected for analysis, deliverable requirements are identified, and due dates are specified on the Service Request. For SW-846 methods, some projects may require the most recent promulgated version, and some projects may require the most recent published version. The Project Manager will ensure that the correct method version is used. Functionality incorporated in the LIMS is used to communicate and specify project-specific requirements and demographics, including the use of attachments to LIMS delivery group (SDG or SR) such as specification forms, analyte lists, deliverable requirements, and other pertinent information.

Figure 11–1

ALS Environmental Standard Chain of Custody Form

ALS Environmental

CHAIN OF CUSTODY

SR# ______

1317 South 13th Ave., Kelso, WA 98626 | 360.577.7222 | 800.695.7222 | 360.636.1068 (fax)

PAGE ______ OF ______ COC# ______

PROJECT NAME
PROJECT NUMBER
PROJECT MANAGER
COMPANY NAME
ADDRESS
CITY/STATE/ZIP
E-MAIL ADDRESS
PHONE # FAX #
SAMPLER'S SIGNATURE

Analysis columns:
- NUMBER OF CONTAINERS
- Semivolatile Organics by GC/MS 625☐ 8270☐ SIM PAH☐
- Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐
- Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐
- Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐
- PCBs Aroclors☐ Congeners☐
- Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐
- Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐
- Metals, Total or Dissolved (See List below)
- Cyanide☐ Hex-Chrom☐
- (circle) pH, Cond, Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS, Turb.
- (circle) NH_3-N, COD, TKN, TOC, DOC, NO_2+NO_3, T-Phos
- TOX 9020☐ AOX 1650☐ 506☐
- Alkalinity☐ CO_3☐ HCO_3☐
- Dioxins/Furans 1613☐ 8290☐
- Dissolved Gases RSK 175☐ Methane☐ Ethene☐ Ethane☐ CO_2☐

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX																				REMARKS

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

INVOICE INFORMATION

P.O. # ______

Bill To: ______

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.

___ 5 day

___ Standard (15 working days)

___ Provide FAX Results

______ Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

***INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: ______ (CIRCLE ONE)**

SPECIAL INSTRUCTIONS/COMMENTS:

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
Signature	Date/Time	Signature	Date/Time	Signature	Date/Time	Signature	Date/Time
Printed Name	Firm	Printed Name	Firm	Printed Name	Firm	Printed Name	Firm

PC______

Cooler Receipt and Preservation Form

Client ______________________________ Service Request *K18* ______________________

Received: ____________ Opened: ____________ By: __________ Unloaded: ____________ By: __________

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* ______________ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? ______________

   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* ______________
5. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
6. Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA Y N

   If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
12. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: ____

7/25/16 ***Page*** ____ ***of*** _____

Cooler Receipt and Preservation Form

Client ______________________________ Service Request *K18*______________

Thermometer ID	Corr. Factor	@20 min, Raw Blank	@20 min, Corr. Blank	@40 min. Raw Blank	@40 min. Corr. Blank	@60 min. Raw Blank	@60 min Corr. Blank

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions:

7/25/16

Page____of____

Cooler Receipt and Preservation Form

Client ______________________________ Service Request *K18* ______________

Notes, Discrepancies & Resolutions:

7/25/16

***Page*____*of*____**

12) Analytical Procedures

ALS - Kelso employs methods and analytical procedures from a variety of external sources. The primary method references are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III, IVA, IVB, V, and online updates for hazardous waste samples, and USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, EPA 40CFR parts 136 and 141 and associated Method Update Rules and Supplements; Standard Methods for the Examination of Water and Wastewater for water and wastewater samples, and American Society for Testing and Materials (ASTM). Complete citations for these references can be found in Section 23. Other published procedures, such as state-specific methods, program-specific methods (such as Puget Sound Protocols), or in-house methods may be used. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection/reporting limit, the expected concentration of the analyte(s) being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. The implementation of methods by ALS - Kelso is described in SOPs specific to each method. A list of NELAP-accredited methods is given in Appendix J.

12.1 Standard Operating Procedures (SOPs) and Laboratory Notebooks.

ALS Environmental, Kelso maintains SOPs for use in both technical and administrative functions. SOPs are written following standardized format and content requirements as described in SOP *Preparation of Standard Operating Procedures* (CE-GEN009). Each SOP is reviewed and approved by a minimum of two managers (the Laboratory Director and/or Department Manager and the Quality Assurance Manager). All SOPs undergo a documented review to make sure current practices are described. The QAM maintains a comprehensive list of current SOPs. The document control process ensures that only the most currently approved version of an SOP is being used. The procedures for document control are described in SOP *Document Control* (CE-GEN005). In addition to SOPs, each laboratory department maintains the current methods used to perform analyses accessible to all laboratory staff. Laboratory notebook entries are standardized using the procedure in SOP *Making Entries onto Analytical Records* (CE-QA007). Laboratory notebook entries are reviewed and approved by the appropriate supervisor at a regular interval. A list of current SOPs is given in Appendix G.

12.2 Deviation from Standard Operating Procedures

When a client requests a modification to an SOP (such as a change in reporting limit, addition or deletion of target analyte(s), etc.), the Project Manager handling that project must discuss the proposed deviation with the department manager in charge of the analysis and obtain their approval to accept the project. The Project Manager is responsible for documenting the approved or allowed deviation from the SOP by placing a description of the deviation attached with the project documents and also providing an instructional comment with the Service Request.

For circumstances when a deviation or departure from company policies or procedures involving any non-technical function is found necessary, approval must be obtained from the appropriate supervisor, manager, the Laboratory Director, or other level of authority. Frequent departure from policy is not encouraged. However, if frequent departure from any policy is noted, the laboratory director will address the possible need for a change in policy.

12.3 Modified Procedures

ALS - Kelso strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a “Modified” method in the analytical report. Modifications to the published methods are listed in the standard operating procedure. Standard operating procedures are available to analysts and are also available to our clients for review. Client approval is obtained for the use of “Modified” methods prior to the performance of the analysis.

12.4 Analytical Batch

The basic unit for analytical quality control is the analytical batch. The definition that ALS - Kelso has adopted for the analytical batch is listed below. The overriding principle for describing an analytical batch is that all the samples in a batch, both field samples and quality control samples are to be handled exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner. The minimum requirements of an analytical batch are:

1) The number of (field) samples in a batch is not to exceed 20.

2) All (field) samples in a batch are of the same matrix.

3) The QC samples to be processed with the (field) samples include:

- Method Blank (a.k.a. Laboratory Reagent Blank)
- Laboratory Control Sample
- Matrix Spiked (field) Sample (a.k.a. Laboratory Fortified Sample Matrix)*
- Duplicate Matrix Spiked (field) Sample or Duplicate (field) Sample (a.k.a. Laboratory Duplicate)*

* A sample identified as a field blank, an equipment blank, or a trip blank is not to be matrix spiked or duplicated.

4) A single lot of reagents is used to process the batch of samples.

5) Each operation within the analysis is performed by a single analyst, technician, chemist, or by a team of analysts/technicians/chemists.

6) Samples are analyzed in a continuous manner over a timeframe not to exceed 24-hours between the start of processing of the first and last sample of the batch.

7) Samples are analyzed in a continuous manner over a timeframe not to exceed 24-hours.

8) Field samples are assigned to batches commencing at the time that sample processing begins.

9) The QC samples are to be analyzed in conjunction with the associated field samples prepared with them. However, for tests which have a separate sample preparation step that defines a batch (digestion, extraction, etc.), the QC samples in the batch do not require analysis each time a field sample within the preparation batch is analyzed (multiple instrument sequences to analyze all field samples in the batch need not include re-analyses of the QC samples).

10) The batch is to be assigned a unique identification number that can be used to correlate the QC samples with the field samples.

11) Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.

12) Project-specific requirements may be exceptions. If project, program, or method requirements are more stringent than these laboratory minimum requirements, then the project, program, or method requirements will take

precedence. However, if the project, program, or method requirements are less stringent than these laboratory minimum requirements, these laboratory minimum requirements will take precedence.

12.5 Specialized Procedures

ALS - Kelso not only strives to provide results that are scientifically sound, legally defensible, and of known and documented quality; but also strives to provide the best solution to analytical challenges. Procedures using specialized instrumentation and methodology have been developed to improve sensitivity (provide lower detection limits), selectivity (minimize interferences while maintaining sensitivity), and overall data quality for low concentration applications. Examples are trace-level Mercury and Methyl Mercury analyses, reductive precipitation metals analysis, leaching procedures, incremental sampling protocols, specialized GC/MS analyses, LC/MS analyses, and ultra-low level organics analyses (including PAHs, pesticides and PCBs); including those for emerging contaminants of concern.

12.6 Sample Cleanup

The laboratory commonly employs several cleanup procedures to minimize known common interferences prior to analysis. EPA methods (3620, 3630, 3640, 3660, and 3665) for cleanup of sample extracts for organics analysis are routinely used to minimize or eliminate interferences that may adversely affect sample results and data usability.

13) Measurement Traceability and Calibration

All equipment and instruments used at ALS - Kelso are operated, maintained and calibrated according to the manufacturer's recommendations and criteria set forth in the analytical methods. All analytical measurements generated are performed using materials that are traceable to a reference material, unless unavailable. Documentation of calibration information is maintained in appropriate reference files. Brief descriptions of the calibration procedures for our major laboratory equipment are described below. Calibration verification is performed according to the analytical methods and SOPs, and criteria are listed in the SOPs. Documentation of calibration verification is maintained in appropriate reference files. Records are maintained to provide traceability of reference materials and reference equipment.

Laboratory support equipment (thermometers, balances, and weights) are routinely verified on an annual basis by a vendor accredited to ISO/IEC 17025:2005, or more frequently if program-specified. Metrology equipment (analytical balances, thermometers, etc.) is calibrated using reference materials traceable to the National Institute of Standards and Technology (NIST). These primary reference materials are themselves recertified on an annual basis. Vendors used for metrology support are required to verify compliance to International Standards by supplying the laboratory with a copy of their scope of accreditation.

Equipment shown by verification to be malfunctioning or defective is taken out of service until it is repaired. When an instrument is taken out of service, an “Out of Service” sign is placed by the laboratory on the instrument. The equipment is placed back in service only after verifying, by calibration, that the equipment performs satisfactorily.

13.1 Temperature Control Devices

Temperatures are monitored and recorded each day for all of the temperature-regulating support equipment such as sample refrigerators, freezers, and standards refrigerators/freezers. Temperatures are recorded in either laboratory logbook or through Check Point® Wireless Monitoring System. During weekends and holidays a min/max thermometer may be used.

Laboratory records contain the recorded temperature, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. The procedure for performing these measurements is provided in the SOP *Support Equipment Monitoring and Calibration* (ADM-SEMC).

Where the operating temperature is specified as a test condition (such as ovens, incubators, evaporators) the temperature is recorded on the raw data. All thermometers are identified according to serial number, and the calibration is checked annually against a National Institute of Standards and Technology (NIST) certified thermometer. The NIST thermometer is recertified by a vendor accredited to ISO/IEC 17025:2005 on an annual basis.

13.2 Analytical Balances

The calibration of each analytical balance is checked by the user each day of use with three Class S or S-1 weights, which assess the accuracy of the balance at low, mid-level and high levels bracketing the working range. Records are kept which contain the recorded measurements, identification of the balance, acceptance criteria, and the initials of user who performed the check. The procedure for performing these measurements and use of acceptance criteria is described in the SOP *Support Equipment Monitoring and Calibration* (ADM-SEMC). The weights are recertified using NIST traceable standards by an accredited metrology organization on an annual basis. As needed, the balances are recalibrated using the manufacturers recommended operating procedures. Analytical balances are serviced on a semi-annual basis by an accredited metrology organization.

13.3 Water Purification Systems

ALS - Kelso uses two independent water purification systems is designed to produce deionized water meeting method specifications. One system consists of a series of pumps, filters, and resin beds designed to yield deionized water meeting the specifications of ASTM Type II water, and Standard Methods for the Examination of Water and Wastewater (SM1080, 20th Ed.) High Quality water. Activated carbon filters are also in series with the demineralizers to produce "organic-free" water. A second system consists of pumps, filters, and treatment components designed to yield deionized water meeting the specifications of ASTM Type I water, and Standard Methods for the Examination of Water and Wastewater (SM1080, 20th Ed.) High Quality water. The status of each system is monitored continuously for conductivity and resistivity with an on-line meter and indicator light, and readings recorded daily. The meter accuracy is verified annually. Deionizers are rotated and replaced on a regular schedule. Microbiology water is checked on a daily basis at a point downstream of the purification system at a tap in the laboratory.

13.4 Standards and Reference Materials

Consumable reference materials routinely purchased by the laboratories (e.g., analytical standards) are purchased from nationally recognized, reputable vendors. All vendors where possible have fulfilled the requirements for 9001 certification and/or are ISO 17025 accredited. ALS - Kelso relies on a primary vendor for the majority of its analytical supplies. Consumable primary stock standards are obtained from certified commercial sources or from sources referenced in a specific method. Supelco, Ultra Scientific, AccuStandard, Chem Services, Inc., Aldrich Chemical Co., Baker, Spex, etc. are examples of the vendors used. Reference material information is recorded in the appropriate logbook(s) and materials are stored under conditions that provide maximum protection against deterioration and contamination. The logbook entry includes such information as an assigned logbook identification code, the source of the material (i.e. vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. The date that the standard is received in the laboratory is marked on the container. When the reference material is used for the first time, the date of usage and the initials of the analyst are also recorded on the container.

Stock solutions and calibration standard solutions are prepared fresh as often as necessary according to their stability. All standard solutions are properly labeled as to analyte concentration, solvent, date, preparer, and expiration date; these entries are also recorded in the appropriate notebook(s) following the SOP for *Reagent Login and Tracking* (ADM-RTL). Prior to sample analysis, all calibration reference materials are verified with a second, independent source of the material.

13.5 Inductively Coupled Plasma-Atomic Emission Spectrograph (ICP-AES)

Each emission line on the ICP is calibrated daily against a blank and against standards whose concentrations fall within the instruments linear range. Analyses of calibration standards, initial and continuing calibration verification standards, and inter-element interference check samples are carried out as specified in the applicable method SOP and analytical method (i.e. EPA 200.7, 6010B, 6010C, CLP SOW, etc.).

13.6 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)

Each element of interest is calibrated for using a blank and a single standard. Prior to calibration, a short-term stability check is performed on the system. Following calibration, an independent check standard is analyzed, and a continuing calibration verification standard (CCV) is analyzed with every ten samples.

13.7 Atomic Absorption Spectrophotometers (AAS)

These instruments are calibrated daily using a minimum of four standards and a blank. Calibration is validated using reference standards, and is verified at a minimum frequency of once every ten samples. Initial calibration points cannot be “dropped” from the resulting calibration curve.

13.8 GC/MS Systems

All GC/MS instruments are calibrated at multiple concentration levels for the analytes of interest (unless specified otherwise) using procedures outlined in Standard Operating Procedures and/or appropriate USEPA method citations. All reference materials used for this function are vendor-certified standards. Calibration verification is performed at method-specified intervals following the procedures in the SOP. For internal standard and isotope dilution procedures, the internal standard response and/or labeled compound recovery must meet method criteria. Method-specific instrument tuning is regularly checked the method-specified compounds. Mass spectra for the tuning compounds must meet method/SOP criteria before analyses can proceed. Calibration policies for organics chromatographic analyses are described in the SOP *Calibration of Instruments for Organics Chromatographic Analyses* (SOC-CAL).

13.9 Gas Chromatographs and High Performance Liquid Chromatographs

Calibration and standardization follow SOP guidelines and/or appropriate USEPA method citations. All GC and HPLC instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise). The lowest standard is equivalent to the method reporting limit; additional standards define the working range of the GC or LC detector. Results are used to establish response factors (or calibration curves) and retention-time windows for each analyte. Calibration is verified at a minimum frequency of once every ten samples, unless otherwise specified by the reference method. Calibration policies for organics chromatographic analyses are described in the SOP *Calibration of Instruments for Organics Chromatographic Analyses* (SOC-CAL).

LC/MS Systems:

Calibration and tuning procedures are included in analytical SOPs written specifically for these tests. In general, multiple concentration levels for the analytes of interest are used to generate calibration curves. All reference materials used for this function are vendor-certified standards. Calibration and tuning verification is performed at SOP-defined intervals. Any other system performance checks are described in the applicable SOP. Calibration policies for organics chromatographic analyses are described in the SOP *Calibration of Instruments for Organics Chromatographic Analyses* (SOC-CAL).

13.10 UV-Visible Spectrophotometer (manual colorimetric analyses)

Routine calibrations for colorimetric and turbidimetric analyses involve generating a 5 point calibration curve including a blank. Initial calibration points cannot be “dropped” from the resulting calibration curve. Correlation coefficients must meet method or SOP specifications before analysis can proceed. Independent calibration verification standards (ICVs) are analyzed with each batch of samples. Continuing calibration is verified at a minimum frequency of once every ten samples. Typical UV-Visible spectrophotometric methods at ALS Environmental, Kelso include total phenolics, phosphates, surfactants and tannin-lignin.

13.11 Flow Injection Analyzer (automated colorimetric analysis)

A minimum of six standards and a blank are used to calibrate the instrument for cyanide analysis. A blank and (minimum of) five standards are used to calibrate the instrument for all other automated chemistries. Initial calibration points cannot be “dropped” from the resulting calibration curve. Standard ALS Environmental, Kelso acceptance limits are used to evaluate the calibration curve prior to sample analysis.

13.12 Discrete Auto-Analyzer (automated absorbance analysis)

A minimum of five standards and a blank are used to calibrate the instrument. Initial calibration points cannot be “dropped” from the resulting calibration curve. Method specific acceptance limits are used to evaluate the calibration curve prior to sample analysis.

13.13 Ion Chromatographs

Calibration of the ion chromatograph (IC) involves generating a calibration curve with the method-specified number of points (or more). Initial calibration points cannot be “dropped” from the resulting calibration curve. A correlation coefficient of > 0.995 for the curve is required before analysis can proceed. Quality Control (QC) samples that are routinely analyzed include blanks and laboratory control samples. The target analytes typically determined by the IC include nitrate, nitrite, chloride, fluoride, sulfate and drinking water inorganic disinfection byproducts. Calibration verification is performed at method-specified intervals following the procedures in the SOP and reference method.

13.14 Turbidimeter

Calibration of the turbidimeter requires analysis of three Nephelometric Turbidity Unit (NTU) formazin standards. Quality Control samples that are routinely analyzed include blanks, Environmental Resource Associates QC samples (or equivalent) and duplicates.

13.15 Ion-selective electrode

The method-prescribed numbers of standards are used to calibrate the electrodes before analysis. The slope of the curve must be within acceptance limits before analysis can proceed. Quality Control samples that are routinely analyzed include blanks, LCSs and duplicates.

13.16 Pipets

The calibration of pipets and autopipettors used to make critical-volume measurements is verified following SOP *Checking Volumetric Labware* (ADM-VOLWARE). Both accuracy and precision verifications are performed, at intervals applicable to the pipet and use. The results of all calibration verifications are recorded in bound logbooks.

13.17 Other Instruments

Calibration for the total organic carbon (TOC), total organic halogen (TOX), and other instruments is performed following manufacturer's recommendations and applicable SOPs.

14) Assuring the Quality of Results

A primary focus of ALS - Kelso's QA Program is to ensure the accuracy, precision and comparability of all analytical results. Prior to using a procedure for the analysis on field samples, acceptable method performance is established by performing demonstration of capability analyses. Performance characteristics are established by performing method detection limit studies and assessing accuracy and precision according to the reference method. ALS - Kelso has established Quality Control (QC) objectives for precision and accuracy that are used to determine the acceptability of the data that is generated. These QC limits are either specified in the test methodology or are statistically derived based on the laboratory's historical data. Quality Control objectives are defined below.

14.1 Quality Control Objectives

14.1.1 Demonstration of Capability - A demonstration of capability (DOC) is made prior to using any new test method or when a technician is new to the method. This demonstration is made following regulatory, accreditation, or method specified procedures. In general, this demonstration does not test the performance of the method in real world samples, but in the applicable clean matrix free of target analytes and interferences.

A quality control sample material may be obtained from an outside source or may be prepared in the laboratory. The analyte(s) is (are) diluted in a volume of clean matrix (for analytes which do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples). Where specified, the method-required concentration levels are used. Four aliquots are prepared and analyzed according to the test procedure. The mean recovery and standard deviations are calculated and compared to the corresponding acceptance criteria for precision and accuracy in the test method or laboratory-generated acceptance criteria (if there are not established mandatory criteria). All parameters must meet the acceptance criteria. Where spike levels are not specified, actual Laboratory Control Sample results may be used to meet this requirement, provided acceptance criteria is met.

14.1.2 Accuracy - A measure of the closeness of an individual measurement (or an average of multiple measurements) to a true or expected value and expressed as percent recovery (% REC.) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis or caused by an artifact of the measurement system (e.g., contamination). Ongoing accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory control sample, standard reference materials, or standard solutions. In addition, matrix-spiked samples are also measured and recovery indicates the accuracy or bias in the actual sample matrix.

ALS - Kelso utilizes several quality control measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

14.1.3 Precision - Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis. The American Society of Testing and Materials (ASTM) recognizes two levels of precision: repeatability - the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions, and reproducibility - the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material.

"Within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

14.1.4 Control Limits - The control limits for accuracy and precision originate from two different sources. For analyses having enough QC data, control limits are calculated at the 99% confidence limits. For analyses not having enough QC data, or where the method is prescriptive, control limits are taken from the method on which the procedure is based. If the method does not have stated control limits, then control limits are assigned method-default or reasonable values based on similar methods. Control limits are reviewed each year and may be updated if new statistical limits are generated for the appropriate surrogate, laboratory control sample, and matrix spike compounds (typically once a year) or when method prescribed limits change. The updated limits are reviewed by the QAM. The new control limits replace the previous limits and data is assessed using the new values. Current *Data Quality Objectives*, including acceptance limits for accuracy and precision are available from the laboratory. For inorganics, the precision limit values listed are for laboratory duplicates. For organics, the precision limit values listed are for duplicate laboratory control samples or duplicate matrix spike analyses. Procedures for establishing control limits are found in SOP *Control Limits* (CE-QA009).

14.1.5 Representativeness - The degree to which the field sample, being properly preserved, free of contamination, and properly analyzed, represents the overall sample site or material. This can be extended to the sample itself, in that representativeness is the degree to which the subsample that is analyzed represents the entire field sample submitted for analysis. ALS - Kelso has sample handling procedures to ensure that the sample used for analysis is representative of the entire sample. These include the SOP for *Subsampling and Compositing of Samples* (SOILPREP-SUBS) and the SOP for *Tissue Sample*

Preparation (MET-TISP). Further, analytical SOPs specify sample handling and sample sizes to further ensure the sample aliquot that is analyzed is representative in entire sample.

14.1.6 Comparability – Comparability expresses the confidence with which one data set can be compared to another and is directly affected by data quality (accuracy and precision) and sample handling (sampling, preservation, etc.). Only data of known quality can be compared. The objective is to generate data of known quality with the highest level of comparability, completeness, and usability. This is achieved by employing the quality controls listed below and standard operating procedures for the handling and analysis of all samples. Data is reported in units specified by the client and using ALS Environmental, Kelso or project-specified data qualifiers.

14.2 Method Detection Limits, Method Reporting Limits, Limits of Detection, and Limits of Quantitation

Method Detection Limits (MDL) for methods performed at ALS - Kelso are determined during initial method set up and when significant changes are made. If an MDL study is not performed annually, the established MDL is verified by performing a Limit of Detection (LOD) verification on every instrument used in the analysis. The MDLs are determined by following the SOP *Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation* (CE-QA011), which is based on the procedure in 40 CFR Part 136, Appendix B. As required by NELAP and DoD protocols, the validity of MDLs is verified using LOD verification samples.

The Method Reporting Limit (MRL) is the lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (i.e. Limit of Quantitation- LOQ). LOQ are analyzed at the frequency specified in the SOP *Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation* (CE-QA011) and at specified concentrations (not lower than the lowest calibration standard). Current MDL/LOD and MRL/LOQ values are available from the laboratory.

14.3 Quality Control Procedures

The specific types, frequencies, and processes for quality control sample analysis are described in detail in method-specific standard operating procedures and listed below. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below. Unique test-specific requirements may also exist and are found in the laboratory SOP.

14.3.1 Method Blank (a.k.a. Laboratory Reagent Blank)

The method blank is an analyte-free matrix (water, soil, etc.) subjected to the entire analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand, or an acceptable substitute is used. The method blank is analyzed to demonstrate that the analytical system itself does not introduce contamination. The method blank results should be below the Method Reporting Limit (MRL) or, if required for DoD projects, < ½ MRL for the analyte(s) being tested. Otherwise, corrective action must be taken. A method blank is included with the analysis of every sample preparation batch, every 20 samples, or as stated in the method, whichever is more frequent.

14.3.2 Calibration Blank

For some methods, calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest and, where applicable, provide the zero point of the calibration curve. Additional project-specific requirements may also apply to calibration blanks.

14.3.3 Continuing Calibration Blank

Continuing calibration blanks (CCBs) are solutions of analyte-free water, reagent, or solvent that are analyzed in order to verify the system is contamination-free when CCV standards are analyzed. The frequency of CCB analysis is either once every ten samples or as indicated in the method, whichever is greater. Additional project-specific requirements may also apply to continuing calibration blanks.

14.3.4 Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard or stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used.

14.3.5 Initial (or Independent) Calibration Verification Standard (ICV)

The ICV standard is prepared from materials obtained from a source independent of that used for preparing the calibration standards ("second-source"). The ICV is analyzed after calibration but prior to sample analysis in order to verify the validity and accuracy of the standards used in calibration. Once it is determined that there is no defect or error in the calibration standard(s), the standards are considered valid and may be used for subsequent calibrations and quantitative determinations (as expiration dates and methods allow). ICVs are also analyzed in accordance with method-specific requirements.

14.3.6 Continuing Calibration Verification Standard

Continuing calibration verification (CCV) standards are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency of CCV analysis is either once every ten samples, or as indicated in the method.

14.3.7 Internal Standards

Internal standards are known amounts of specific compounds that are added to each sample prior to instrument analysis. Internal standards are generally used for GC/MS and ICP/MS procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by matrix effects. The requirements for evaluation of internal standards are specified in each method and SOP.

14.3.8 Surrogates

Surrogates are organic compounds which are similar in chemical composition and analytical behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards, and samples (including duplicates, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate, and the recovery is a measurement of the overall method performance.

Recovery (%) = (M/T) x 100

Where: M = The measured concentration of analyte,
T = The known concentration of analyte added.

14.3.9 Laboratory Control Samples (a.k.a Laboratory Fortified Blank – LFB)

The laboratory control sample (LCS) is an aliquot of analyte-free water or analyte-free solid (or anhydrous sodium sulfate or equivalent) to which known amounts of the method analyte(s) is (are) added. A reference material of known matrix type, containing certified amounts of target analytes, may also be used as an LCS. An LCS is prepared and analyzed at a minimum frequency of one LCS per 20 samples, with every analytical batch or as stated in the method, whichever is more frequent. The LCS sample is prepared and analyzed in exactly the same manner as the field samples.

The percent recovery of the target analytes in the LCS is compared to established control limits and assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy.

Recovery (%) = (M/T) x 100

Where: M = The measured analyte concentration,
T = The known analyte concentration added.

14.3.10 Laboratory Fortified Blank – MRL Level

A laboratory blank fortified at the MRL used to verify that the method reporting limit can be achieved. This LFB is carried through the entire extraction and analytical procedure. A MRL LFB is required with every batch of drinking water samples.

14.3.11 Matrix Spikes (MS)

Matrix spiked samples are aliquots of samples to which a known amount of the target analyte (or analytes) is (are) added. The samples are then prepared and analyzed in the same analytical batch, and in exactly the same manner as are routine samples. For the appropriate methods, matrix spiked samples are prepared and analyzed and at a minimum frequency of one spiked sample (and one duplicate spiked sample, if appropriate) per twenty samples. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

Recovery (%) = (S - A)/T x 100

Where: S = The measured analyte concentration in the spiked sample,
A = The measured analyte concentration in the parent sample,
T = The known analyte concentration added to the spiked sample.

14.3.12 Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate analysis (and/or a matrix spiked sample) or a matrix spiked sample and duplicate matrix spiked sample (MS/DMS) are analyzed. The relative percent difference between duplicate analyses or between an MS and DMS is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

Relative Percent Difference (RPD) = (S1 - S2) x 100 ÷ S_{avg}

Where:

S1 and S2 = The analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and,

S_{avg} = The average of analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Depending on the method of analysis, either duplicates (and/or matrix spikes) or MS/DMS analyses are performed at a minimum frequency of one set per 20 samples. If an insufficient quantity of sample is available to perform a laboratory duplicate or duplicate matrix spikes, duplicate LCSs will be prepared and analyzed.

14.3.13 Interference Check Samples (ICS)

An ICS is a solution containing both interfering and analyte elements of known concentration that can be analyzed to verify background and interelement correction factors in metals analyses. The ICS is prepared to contain known concentrations (method or program specific) of elements that will provide an adequate test of the correction factors. The ICS is analyzed at the beginning and end of an analytical run or at a method-specified frequency. Results must meet method criteria and any project-specific criteria.

14.3.14 Post Digestion Spikes

Post digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum concentration above the method reporting limit. A post digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

14.3.15 Control Charting

The generation of control charts is routinely performed at ALS. Surrogate, Matrix Spike and LCS recoveries are all monitored and charted. In addition, the laboratory also monitors the Relative Percent Difference (RPD) measurement of precision. Control charts are available to each individual laboratory unit to monitor the data generated in its facility using control charts that have been programmed to identify various trends in the analytical results. If trends in the data are perceived, various means of corrective action may then be employed in order to prevent future problems with the analytical system(s). Finally, data quality reports using control charts are generated for specific clients and projects pursuant to contract requirements. The control charting procedure is described in SOP *Control Limits* (CE-QA009).

14.3.16 Glassware Washing

Glassware washing and maintenance play a crucial role in the daily operation of a laboratory. The glassware used at ALS - Kelso undergoes a rigorous cleansing procedure prior to every usage. A number of SOPs have been generated that outline the various procedures used at ALS; each is specific to the end-use of the equipment as well as to the overall analytical requirements of the project. In addition, other equipment that may be routinely used at the laboratory is also cleaned following instructions in the appropriate SOP.

14.3.17 Uncertainty

Measurement uncertainty is associated with most of the results obtained in laboratory testing. It may be meaningful to estimate the extent of the uncertainty associated with each result generated by the laboratory. It is also useful to recognize that this measurement uncertainty is likely to be much less than that associated with sample collection activities. The uncertainty associated with the analytical measurement processes can be estimated from quality control data. When requested, the laboratory provides uncertainty information as described in the SOP *Estimate of Uncertainty of Analytical Measurements* (CE-QA010). The estimation of uncertainty relates only to measurements conducted in the laboratory.

14.4 When data quality objectives or quality control measures are not met, due to the sample matrix or anomalies, incompatibility of the methodology and sample type, statistical outliers, random error, or other factors, it may be necessary to apply data qualifiers to reported data. A list of standard data qualifiers is given in Appendix H.

15) Control of Non-Conforming Environmental Testing Work

The laboratory takes all appropriate steps necessary to ensure all sample results are reported with acceptable quality control results. When sample results do not conform to established quality control procedures, responsible management will evaluate the significance of the nonconforming work and take corrective action to address the nonconformance.

Nonconforming events such as errors, deficiencies, deviations from SOP, proficiency (PT) failure or results that fall outside of established QC limits are documented using the NCAR database. The procedure and responsibilities for addressing nonconforming work is defined in SOP *Nonconformance and Corrective Action* (CE-QA008). Nonconformances are reported to the client using various means (voice, email, narrative, etc.). When a nonconformance occurs that casts doubt on the validity of the test results or additional client instructions are needed, the Project Manager notifies the client the same business day that the nonconformance is confirmed and reported. The QAM reviews each problem, ensuring that appropriate corrective action has been taken by the appropriate personnel. The QAM periodically reviews all NCARs looking for chronic, systematic problems that need more in-depth investigation and alternative corrective action consideration. In addition, the appropriate Project Manager is promptly notified of any problems in order to inform the client and proceed with any action the client may want to initiate.

Results from non-conforming environmental testing work generally require the need for qualified data on analytical reports. A list of standard data qualifiers is given in Appendix H. Additionally, the report narrative will provide an explanation of the nonconformance and potential impact on results.

16) Corrective Action, Preventive Action, and Improvement

If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). Failure to meet established analytical controls, such as the quality control objectives, prompts corrective action. Corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the supervisor, team leader, the department manager, and/or the QAM may examine and pursue alternative solutions. In addition, the appropriate Project Manager is notified in order to ascertain if the client needs to be notified.

Part of the corrective action process involves determining the root cause. Identifying the root cause of a nonconformance can be difficult, but important for implementing effective corrective action. Root cause principles are used to determine assignable causes, which leads to corrective action taken to prevent recurrence. Various preventive action processes are used for eliminating a potential problem or averting a problem before it occurs. This is explained in SOP *Nonconformance and Corrective Action* (CE-QA008).

Preventive action is focused on using existing information or experiences to anticipate potential problems and eliminating the likely causes of them. Preventive action is a pro-active process and tied to results from corrective action as well as opportunities for improvement. ALS – Kelso used preventive action processes to avoid errors and implement improvements. The SOP *Preventive Action* (CE-GEN004) describes procedures used. Examples of preventive action are given in the SOP. The laboratory also uses ideas from staff, client feedback, and other input mechanisms to identify potential improvements. The monthly lab-wide meeting regularly includes reports on improvements made or underway.

16.1 Preventive maintenance

Preventive maintenance is a crucial element of the QA program. Equipment and instruments at ALS - Kelso are regularly maintained by qualified laboratory staff or under commercial service contracts. All instruments are operated and maintained according to the instrument operating manuals. All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at ALS Environmental, Kelso contain extensive information about the instruments used at the laboratory, including:

- The equipment’s serial number;
- Date the equipment was received;
- Date the equipment was placed into service;
- Condition of equipment when received (new, used, reconditioned, etc.); and
- Prior history of damage, malfunction, modification or repair (if known).

Preventive maintenance procedures, frequencies, etc. are available for each instrument used at ALS. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase.

Responsibility for ensuring that routine maintenance is performed lies with the section supervisor. In the case of non-routine repair of capital equipment, the section supervisor is responsible for providing the repair, either by performing the repair themselves with manufacturer guidance or by acquiring on-site manufacturer repair. Each laboratory section maintains a critical parts inventory. This inventory or “parts list" also includes the items needed to perform any other routine maintenance and certain in-house non-routine repairs such as gas chromatography/mass spectrometry jet separators and electron multipliers and ICP/MS nebulizer. When performing maintenance on an instrument (whether preventive or corrective), additional information about the problem, attempted repairs, etc. is also recorded in the notebook. Typical logbook entries include the following information:

- Details and symptoms of the problem;
- Repairs and/or maintenance performed;
- Description and/or part number of replaced parts;
- Source(s) of the replaced parts;
- Analyst's signature and date; and
- Demonstration of return to analytical control.

See the Appendix E for a list of equipment and whether primarily maintained by laboratory of service providers.

17) Control of Records

ALS - Kelso maintains a records system which ensures that all laboratory records of analysis data retained and available. Analysis data is retained for 5 years from the report date unless contractual terms or regulations specify a longer retention time. The archiving system is described in the SOP for *Data Archiving* (ADM-ARCH).

17.1 Documentation and Archiving of Sample Analysis Data

The archiving system includes the following items for each set of analyses performed:

- Benchsheets describing sample preparation (if appropriate) and analysis;
- Instrument parameters (or reference to the data acquisition method);
- Sample analysis sequence;
- Instrument printouts, including chromatograms and peak integration reports for all samples, standards, blanks, spikes and reruns;
- Logbook ID number for the appropriate standards;
- Copies of report sheets submitted to the work request file; and
- Copies of Nonconformity and Corrective Action Reports, if necessary.

Individual sets of analyses are identified by analysis date and service request number. Since many analyses are performed with computer-based data systems, the final sample concentrations can be automatically calculated. If additional calculations are needed, they are written on the integration report or securely stapled to the chromatogram, if done on a separate sheet.

For organics analysis, data applicable to all analyses within the batch, such as GCMS tunes, CCVs, batch QC, and analysis sequences; are kept using a separate documentation system. This system is used to archive data on a batch-specific basis and is segregated according to the date of analysis. This system also includes results for the most recent calibration curves, as well as method validation results.

18) Audits

Quality audits are an essential part of the Quality Assurance program. There are two types of audits used at the facility: System Audits are conducted to qualitatively evaluate the operational details of the QA program, while Performance Audits are conducted by analyzing proficiency testing samples in order to quantitatively evaluate the outputs of the various measurement systems.

18.1 System Audits

The system audit examines the presence and appropriateness of laboratory systems. External system audits of ALS/Kelso are conducted regularly by various regulatory agencies and clients. Appendix J lists the certification and accreditation programs in which ALS/Kelso participates. Programs and certifications are added as required.

Internal system audits of ALS/Kelso are conducted regularly under the direction of the Quality Assurance Manager. The internal audit procedures are described in SOP *Internal Audits* (CE-QA001). The internal audits are performed as follows:

- System audit – this is an annual audit of the implementation of the quality system in the laboratory.
- Process audit – this is an audit of all operational areas in the laboratory to evaluate compliance with operational and technical procedures. Focus is on sample handling, preparation and analysis and technically sound practices. Three primary concepts are 1) is the procedure in use the same as that described in the SOP, 2) the use of sound analytical techniques and practices, and 3) sample handling/preparation. Topics as calibration, sample/analytical batching, standards traceability, QC criteria, instrument operation and maintenance, data interpretation, and reporting results are included. Hardcopy data and/or report audits may be included.

  Process audits may be one larger audit event or a series of audits such that all areas of the laboratory are audited over a one year period. Audits conducted over the four calendar quarters will follow the schedules listed in an audit plan.
- Electronic data audits focus on organic chromatographic data and include an examination of audit trails, peak integrations, calibration practices, GCMS tuning data, use of appropriate files, and other components of the analysis. Each applicable instrument is periodically audited using audit software and randomly selected data files.

All audit findings and corrective actions are documented. The results of each audit are reported to the Laboratory Director and Department Managers for review. Any deficiencies identified are summarized in the audit report. Managers must respond with corrective actions correcting the deficiency within a defined timeframe. Should problems impacting data quality be found during an internal audit, any client whose data is adversely impacted will be given written notification within the corrective action period (if not already provided).

Additional internal audits or data evaluations may be performed as needed to address any potential data integrity issues that may arise.

18.2 Performance Audits

ALS - Kelso participates in the analysis of inter-laboratory proficiency testing (PT) samples. Participation in PT studies is performed on a regular basis and is designed to evaluate all analytical areas of the laboratory. General procedures for these analyses are described in SOP *Proficiency Sample Testing Analysis* (CE-QA006). ALS - Kelso routinely participates in the following studies:

- Water Pollution (WP) and additional water parameters, 2 per year.

- Water Supply (WS) PT studies, 2 per year.
- Hazardous Waste/Soil/UST PT studies, 2 per year.
- Microbiology (WS and WP) PT studies, 2 per year.
- State-specific Underground Storage Tank PT studies, 1 per year, or as specified for accreditation.
- Other studies as required for certifications, accreditations, or validations.

PT samples are processed by entering them into the LIMS system as samples and are processed the same as field samples (following the PT provider instructions). The laboratory sections handle samples the same as field samples, performing the analyses following method requirements and performing data review. The laboratory sections submit results to the QA Manager for subsequent reporting to the appropriate agencies or study provider. Results of the performance evaluation samples and audits are received by the QAM and distributed to Laboratory Director and department managers for review. For any results outside acceptance criteria, the analysis data is reviewed to identify a root cause for the deficiency, and corrective action is taken and documented through nonconformance (NCAR) procedures.

19) Management Review

An annual Review of the laboratory's quality system and testing activities is conducted by the laboratory's management team to ensure the continuing suitability and effectiveness of the quality system and testing activities and to introduce any necessary changes or improvements. The review ensures that the quality system of the laboratory continues to conform to the requirements of the ISO 17025:2005 and various accrediting authorities, including NELAP/TNI.

General procedures for the Review are described in *Laboratory Management Review* (SOP CE-QA005). When conducting the review a standard list of items and categories is evaluated. The quality policies and their relation to testing activities are reviewed and any changes that are necessary are identified. The review also notes significant changes that have taken place or need to take place in the quality system; and the organization, facilities, equipment, procedures, and activities of the laboratory.

The Review is documented by the laboratory QA Manager. Action items, including preventive actions and improvements, should be identified. Results should feed into the laboratory's planning process planning.

20) Personnel

20.1 Personnel Training

Job descriptions, including technical position descriptions, are used for all employees, regardless of position or level of seniority. These documents are maintained by the Human Resources personnel and are available for review. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment are evaluated, in part, against the appropriate technical description.

Training begins the first day of employment at ALS - Kelso when the company policies are presented and discussed. Safety and Quality System requirements are integral parts of initial and ongoing training processes at the laboratory. Safety training begins with the reading of the ALS Chemical Hygiene Plan. Employees are also required to attend periodic safety meetings where additional safety training may be performed by the Environmental, Health and Safety Officer.

Quality Systems training begins with QA orientation for new employees which includes reading the Quality Assurance Manual and ethics/data integrity introductory training. Additional training on laboratory quality systems as they relate to job functions is incorporated into training plans. Employees are responsible for complying with the requirements of the QA Manual and QA/QC requirements associated with their function(s).

ALS - Kelso also encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the company. Ongoing training occurs for all employees through a variety of mechanisms. The corporate, company-wide training and development program, external and internal technical seminars and training courses, and laboratory-specific training exercises are all used to provide employees with professional growth opportunities.

All technical training is documented and records are maintained in the QA department. Training requirements and its documentation are described in SOP *ALS-Kelso Training Procedure* (ADM-TRAIN). A training plan is developed whenever an employee starts a new procedure to new position. The training plan includes a description of the step-by-step process for training an employee and for initial demonstration of capability. Where the analyst performs the entire procedure, a generic training plan may be used.

20.2 Initial Demonstration of Capability (IDOC)

Training in analytical procedures typically begins with the reading of the SOP for the method. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. Successful completion of the applicable Demonstration of Capability analysis qualifies the analyst to perform the method independently. Demonstration of Capability is performed by one of the following:

- Successful completion of an Initial Precision and Recovery (IPR) study (required where mandated by the method).
- Analysis of 4 consecutive Laboratory Control Samples, with acceptable accuracy and precision.
- Where spiking is not possible but QC standards are used ("non-spiked" LCS), analysis of 4 consecutive LCS analyses with acceptable accuracy and precision.
- Where one of the three above is not possible, special requirements are as follows:
  - Total Settleable Solids: Successful single-blind PT sample analysis and duplicate results with RPD<10%.
  - Color: Four consecutive prepared LCSs with acceptable accuracy and precision of <10% RSD.
  - Physical Tests (Grain size, Corrosivity to Steel, etc.): Supervisor acknowledgement of training and approval.

A flowchart identifying the Demonstration of Proficiency requirements is given in Figure 20-1. The flowchart identifies allowed approaches to assessing Demonstration of Capability when a 4-replicate study is not mandated by the method, when spiking is not an option, or when QC samples are not readily available.

20.3 Continuing Demonstration of Proficiency

A periodic demonstration of proficiency is required to maintain continuing qualification. Continuing Demonstration of Proficiency is required each year, and may be performed one of the following ways:

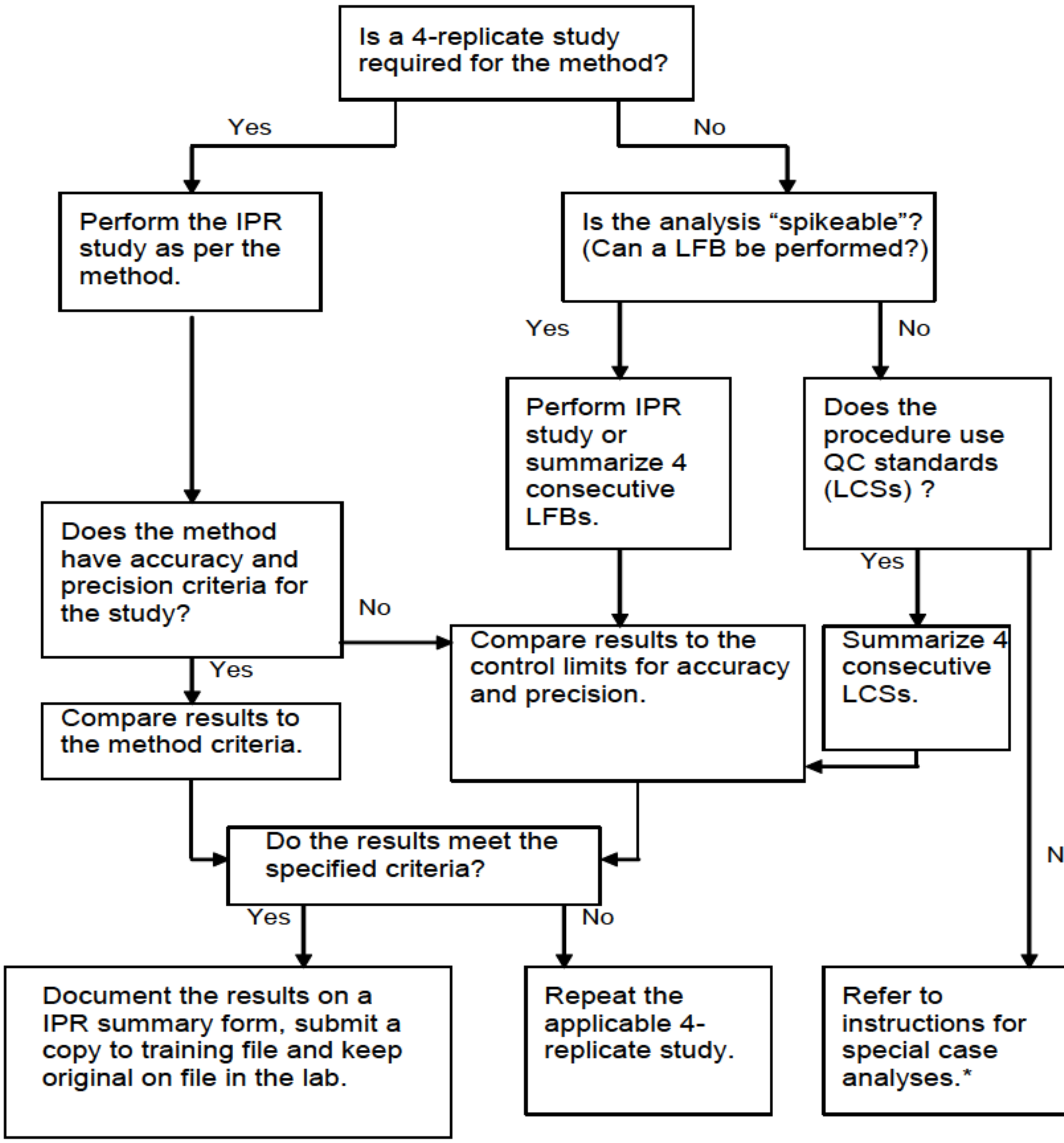
- Successful performance on external (independent) single-blind sample analyses using the test method, or a similar test method using the same technology. I.e. PT sample or QC sample blind to the analyst.
- Performing Initial Demonstration of Capability as described above, with acceptable levels of precision and accuracy.
- Analysis of at least 4 consecutive LCSs with acceptable levels of accuracy and precision from in-control analytical batches.
- If the above cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.
- For methods for which PT samples are not available and a spiked analysis (LFB, MDL, etc.) is not possible, analysis of field samples that have been analyzed by another analyst with statistically indistinguishable results.

20.4 Documentation of Training

Records are maintained to indicate the employee has the necessary training, education, and experience to perform their functions. Information of previously acquired skills and abilities for a new employee is maintained in Human Resources personnel files and internal resumes. The QA department maintains a record of the various technical skills and training acquired while employed by ALS. Information includes the employee's name, a description of the skill including the appropriate method and SOP reference, the mechanism used to document proficiency, and the date the training was completed. General procedures for documenting technical training are described in SOP *ALS-Kelso Training Procedure* (ADM-TRAIN).

Figure 20-1

Demonstration of Proficiency Flowchart



21) Reporting of Results

ALS - Kelso reports the analytical data produced in its laboratories to the client via the Analytical Report. This report includes a transmittal letter, a case narrative, client project information, sample receipt and chain of custody information, specific test results, quality control data (as requested), and any other project-specific support documentation. The following procedures describe the procedures used for data reduction, validation and reporting.

21.1 Data Reduction and Review

Results are generated by the analyst who performs the analysis and works up the raw data. All data is initially reviewed and processed by analysts using appropriate methods (e.g., chromatographic software, instrument printouts, hand calculation, etc.). Equations used for calculation of results are found in the applicable analytical SOPs. Policies and procedures for manual editing of data are established. The analyst making the change must initial and date the edited data entry, without obliteration of the original entry. The policies and procedures are described in the SOP *Making Entries onto Analytical Records* (CE-QA007).

The resulting data set is either manually entered (e.g., titrimetric or microbiological data) into an electronic report form or is electronically transferred into the report. Once the complete data set has been transferred into the proper electronic report form(s), it is then printed. The resulting hardcopy version of the electronic report is then reviewed by the analyst for accuracy. Once the primary analyst has checked the data for accuracy and acceptability, the data and report hardcopy is forwarded to the supervisor or second qualified analyst who reviews the data. Where calculations are not performed using a validated software system, the reviewer rechecks a minimum of 10% of the calculations. Analysts performing routine testing are responsible for generating a data quality narrative or data review document with every analytical batch processed. This report also allows the analyst to provide appropriate notes and/or a narrative if problems were encountered with the analyses. A Nonconformance and Corrective Action Report (NCAR) may also be attached to the data prior to review. Supervisors or qualified analysts review all of the completed analytical batches to ensure that all QC criteria have been examined and any deficiencies noted and addressed. Data review procedures are described in the SOP for *Laboratory Data Review Process* (ADM-DREV).

Policies and procedures for electronic manual integration of chromatographic data are established. The analyst performing the integration must document the integration change by printing both the “before” and “after” integrations and including them in the raw data records. The policies and procedures are described in SOP *Manual Integration Policy* (CE-QA002) and SOP *Manual Integration of Chromatographic Peaks* (ADM-MI).

21.1.1 Validation of Results

The validity of the data generated is assessed through the evaluation of the sample results, calibrations, and QC samples (method blanks, laboratory control samples, sample duplicates, matrix spikes, trip blanks, etc.). A brief description of the evaluation of these analyses is described below, with details listed in applicable SOPs. The criteria for evaluation of QC samples are listed within each method-specific SOP. Other data evaluation measures may include (as necessary) a check of the accuracy check of the QC standards and a check of the system sensitivity. Data transcriptions and calculations are also reviewed.

Note: Within the scope of this document, all possible data assessment requirements for various project protocols cannot be included in the listing below. This listing gives a general description of data evaluation practices used in the laboratory in compliance with NELAP Quality Systems requirements. Additional requirements exist for certain programs, such as projects under the DoD QSM protocols, and project-specific QAPPs.

- Initial Calibration – Following the analysis of calibration standards according to the applicable SOP the data is fit to an applicable and allowed calibration model (correlation coefficient, linear, average response factor, quadratic, etc.) and the resulting calibration is compared to specified criteria. If the calibration meets criteria analysis may continue. If the calibration fails, any problems are isolated and corrected and the calibration standards reanalyzed. Following calibration and analysis of the independent calibration verification standard(s) the percent difference for the ICV is calculated. If the percent difference is within the specified limits the calibration is complete. If not, the problem associated with the calibration and/or ICV are isolated and corrected and verification and/or calibration is repeated.

- Continuing Calibration Verification (CCV) – Following the analysis of the CCV standard the percent difference is calculated and compared to specified criteria. If the CCV meets the criteria analysis may continue. If the CCV fails, routine corrective action is performed and documented and a 2nd CCV is analyzed. If this CCV meets criteria, analysis may continue, including any reanalysis of samples that were associated with a failing CCV. If the routine corrective action failed to produce an immediate CCV within criteria, then either acceptable performance is demonstrated (after additional corrective action) with two consecutive calibration verifications or a new initial calibration is performed.

- Method Blank – Results for the method blank are calculated as performed for samples. If results are less than the MRL (<½ MRL for DoD projects), the blank may be reported. If not, associated sample results are evaluated to determine the impact of the blank result. If possible, the source of the contamination is determined. If the contamination has affected sample results the blank and samples are reanalyzed. If positive blank results are reported, the blank (and sample) results are flagged with an appropriate flag, qualifier, or footnote.

- Sample Results (Inorganic) – Following sample analysis and calculations (including any dilutions made due to the sample matrix) the result is verified to fall within the calibration range. If not, the sample is diluted and analyzed to bring the result into calibration range. When sample and sample duplicates are analyzed for precision, the calculated RPD is compared to the specified limits. The sample and duplicate are reanalyzed if the criteria are exceeded. The samples may require re-preparation and reanalysis. For metals, additional measures as described in the applicable SOP may be taken to further evaluate results (dilution tests and/or post-digestion spikes). Results are reported when within the calibration range, or as estimates when outside the calibration range. When dilutions are performed the MRL is elevated accordingly and qualified. Efforts are made to meet the project MRL's including alternative analysis.

- Sample Results (Organic) – For GC/MS analyses, it is verified that the analysis was within the prescribed tune window. If not, the sample is reanalyzed. Following sample analysis and calculations (including any dilutions made due to the sample matrix) peak integrations, retention times, and spectra are evaluated to confirm qualitative identification. Internal standard responses and surrogate recoveries are evaluated against specified criteria. If internal standard response does not meet criteria, the sample is diluted and reanalyzed. Results outside of the calibration range are diluted to within the calibration range. For GC and HPLC tests, results from confirmation analysis are evaluated to confirm positive results and to determine the reported value. The procedure to determine which result to report is described in the SOP for *Confirmation Procedure for GC and HPLC Analysis* (SOC-CONF). If obvious matrix interferences are present, additional cleanup of the sample using appropriate procedures may be necessary and the sample is reanalyzed. When dilutions are performed the MRL is elevated accordingly and qualified. Efforts are made to meet the project MRL's including additional cleanup.

- Surrogate Results (Organic) – The percent recovery of each surrogate is compared to specified control limits. If recoveries are acceptable, the results are reported. If recoveries do not fall within control limits, the sample matrix is evaluated. When matrix interferences are present or documented, the results are reported with a qualifier that matrix interferences are present. If no matrix interferences are present and there is no cause for the outlier, the sample is reprepared and reanalyzed. However, if the recovery is above the upper control limit with non-detected target analytes, the sample may be reported. All surrogate recovery outliers are appropriately qualified on the report.

- Duplicate Sample and/or Duplicate Matrix Spike Results – The RPD is calculated and compared to the specified control limits. If the RPD is within the control limits the result is reported. If not, an evaluation of the sample is made to verify that a homogenous sample was used. Despite the use of homogenizing procedures prior to sample preparation or analysis, the sample may not be homogenous or duplicate sample containers may not have been sample consistently. If non-homogenous, the result is reported with a qualifier about the homogeneity of the sample. Also, the results are compared to the MRL. If the results are less than five times the MRL, the results are reported with a qualifier that the high RPD is due to the results being near the MRL. If the sample is homogenous and results above five times the MRL, the samples and duplicates are reanalyzed. If re-analysis also produces out-of-control results, the results are reported with an appropriate qualifier.

- Laboratory Control Sample Results – The LCS percent recovery is calculated and compared to specified control limits. If the recovery is within control limits, the analysis is in control and results may be reported. If not, this indicates that the analysis is not in control. Samples associated with the 'out of control' LCS, shall be considered suspect and the samples re-extracted or re-analyzed or the data reported with the appropriate qualifiers. For analysis where a large number of analytes are in the LCS, it becomes more likely that some analytes (marginal exceedances) will be outside the control limits. The procedure described in the 2009 NELAC standards, V1M4 Section 1.7.4.2 are used to determine if the LCS is effective in validating the analytical system and the associated samples.

- Matrix Spike Results – The MS percent recovery is calculated and compared to specified control limits. If the recovery is within control limits the results are reported. If not, and the LCS is within control limits, this indicates that the matrix potentially biases analyte recovery. It is verified that the spike level is at least five times the background level. If not, the results are reported with a qualifier that the background level is too high for accurate recovery determination. If matrix interferences are present or results indicate a potential problem with sample preparation, steps may be taken to improve results; such as performing any additional cleanups, dilution and reanalysis, or re-preparation and reanalysis. Results that do not meet acceptance limits are reported with an appropriate qualifier.

21.1.2 Qualitative Data Evaluation

All sample results and QC results are reviewed to ensure correct identification of target analytes, when not inherent to the test method. Details particular to each analysis are given in the analytical SOP.

Identification criteria for GC, LC or GC/MS methods are summarized below:

- GC and LC Methods
    - The analyte must fall within the retention time window specified in the applicable SOP. The retention time window is established prior to analysis and documented.
    - For analyses all positive results are confirmed by a second column, a second detector, a second wavelength (HPLC/UV), or by GC/MS analysis. Details for confirmation analysis are described in the SOP *Confirmation Procedures for GC and HPLC Analyses* (SOC-CONF). Confirmation data will be provided as specified in the method.
    - When sample results are confirmed by two dissimilar columns or detectors, the agreement between quantitative results must be evaluated. The relative percent difference between the two results is calculated and evaluated against SOP and/or method criteria.
- GC/MS and LC/MS Methods - Two criteria are used to verify identification:
    - Elution of the analyte is at the same relative retention time (as defined by the method) as demonstrated in the standard.
    - The mass spectrum of the analyte in the sample must, in the opinion of a qualified analyst or the department manager, correspond to the spectrum of the analyte in the standard or the current GC/MS reference library.
    - When Tentatively Identified Compounds are to be reported for GC/MS, the spectrum for non-target peaks is compared to the current GC/MS reference library.

21.2 Data Reporting

It is the responsibility of each laboratory unit to provide the Project Manager with a final report of the data for each analysis, accompanied by signature approval. When the entire data set has been found to be acceptable, a final copy of the report is generated and approved by the laboratory supervisor, departmental manager or designated laboratory staff. The entire data package for the analysis is then placed into the service request file, and an electronic copy of the final data package is forwarded to the appropriate personnel for archival. Footnotes and/or narrative notes must accompany any data package if problems were encountered that require further explanation to the client. Each data package is submitted to the appropriate Project Manager.

When all analyses and departmental reports are completed the Project Manager reviews the entire collection of analytical data for completeness and to ensure that any and all client-specified objectives were successfully achieved. A report narrative is written by the Project Manager to explain any unusual problems with a specific analysis or sample, etc. Prior to release of the report to the client, the Project Manager reviews and approves the entire report for completeness and to ensure that any and all client-specified objectives were successfully achieved. The original raw data, along with a copy of the final report, is scanned and archived by service request number.

To the extent possible, samples shall be reported only if all QC measures are acceptable. If a QC measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). The SOP for *Data Reporting and Report Generation* (ADM-RG) addresses the flagging and qualification of data. The ALS-defined data qualifiers, state-specific data qualifiers, or project-defined data qualifiers are used depending on project requirements. A case narrative may be written by the Project Manager to explain problems with a specific analysis or sample, etc.

When requested by the client or relevant to the validity of reported results, the estimation of measurement uncertainty will be provided to a client or regulatory agency. How the uncertainty will be reported may be dictated by the client's reporting specifications. Procedures for determining and reporting uncertainty are given in SOP *Estimation of Uncertainty of Analytical Measurements* (CE-QA010).

For subcontracted analyses, the Project Manager verifies that the report received from the subcontractor is complete. This includes checking that the correct analyses were performed, the analyses were performed for each sample as requested, a report is provided for each analysis, and the report is signed. The Project Manager accepts the report if all verification items are complete. Acceptance is demonstrated by forwarding the report to the client.

21.3 Deliverables

In order to meet individual project needs, ALS - Kelso provides several levels of analytical reports. Standard specifications for each level of deliverable are described in Table 21-1. Variations may be provided based on client or project specifications. This includes (but is not limited to) deliverables for DoD QSM projects and state-specific drinking water formats.

When requested, ALS - Kelso provides Electronic Data Deliverables (EDDs) in the format specified by client need or project specification. ALS - Kelso is capable of generating EDDs with many different formats and specifications. The EDD is prepared by report production staff using the electronic version of the laboratory report to minimize transcription errors. User guides and EDD specification outlines are used in preparing the EDD. The EDD is reviewed and compared to the hard-copy report for accuracy.

Table 21-1
Descriptions of ALS Environmental - Kelso Standard Data Deliverables*
Tier I. Routine Analytical Report includes the following:
• Transmittal letter
• Chain of custody documents and sample/cooler receipt documentation
• Sample analytical results
• Method blank results
• Surrogate recovery results and acceptance criteria for applicable organic methods
• Dates of sample preparation and analysis for all tests
• Case narrative - optional
Tier II. In addition to the Tier I Deliverables, this Analytical Report includes the following:
• Laboratory Control Sample results with calculated recovery and associated acceptance criteria
• Matrix spike results with calculated recovery and associated acceptance criteria if performed on client specific sample. Batch QC not reported unless specifically requested by client.
• Duplicate or duplicate matrix spike result(s) (as appropriate to method), with calculated relative percent difference if performed on client specific sample. Batch QC not reported unless specifically requested by client.
• Case narrative - optional
Tier III. Data Validation Package. In addition to the Tier II Deliverables, this CAR includes the following:
• Case narrative - required
• Summary forms for all associated QC and Calibration parameters, with associated control criteria/acceptance limits if performed on client specific sample. Batch QC not reported unless specifically requested by client.
• Other summary forms specified in QAPPs or project/program protocols, or those related to specialized analyses such as HRGC/MS are included.
Tier IV. Full Data Validation Package.
• All raw data associated with the sample analysis, including but not limited to: • Preparation and analysis bench sheets and instrument printouts, • For organics analyses, all applicable chromatograms, spectral, confirmation, and manual integration raw data. For GC/MS this includes tuning results, mass spectra of all positive results, and the results and spectra of TIC compounds when requested.
• QC data
• Calibration data (initial, verification, continuing, etc.),
• Calibration blanks or instrument blanks (as appropriate to method).

* If a project QAPP or program reporting protocol applies the report will be presented as required for the project.

22) Summary of Changes and Document History

Revision Number	Effective Date	Document Editor	Description of Changes
26.1	6/25/2018	C. Degner	Minor changes and updates to text sections 1-23, updated key personnel, organization charts, and SOP list. Updated appendices.

23) References for Quality System Standards, External Documents, Manuals, and Test Procedures

The analytical methods used at ALS Environmental, Kelso generally depend upon the end-use of the data. Since most of our work involves the analysis of environmental samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Typical methods used at ALS Environmental, Kelso are taken from the following references:

- National Environmental Laboratory Accreditation Program (NELAP), 2009 Quality Standards.
- TNI Standard – Environmental Laboratory Sector, Volume 1, *Management and Technical Requirements for Laboratories Performing Environmental Analysis,* EL-V1-2009.
- Quality Standards. American National Standard *General requirements for the competence of testing and calibration laboratories,* ANSI/ISO/IEC 17025:2005(E)
- *DoD Quality Systems Manual for Environmental Laboratories,* Versions 4.2, 5.0, and 5.1.
- *Good Automated Laboratory Practices, Principles and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185 (August 1995).
- *Manual for the Certification of Laboratories Analyzing Drinking Water*, 5th Edition, EPA 815-B-97-001 (January 2005).
- *Procedure Manual for the Environmental Laboratory Accreditation Program,* Washington Department of Ecology, 10-03-048, September 2010.
- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, (September 1986) and Updates I (July 1992), II (September 1994), IIA (August 1993), IIB (January 1995), III (December 1996), Final Update IV (February 2007), and updates posted online at https://www.epa.gov/hw-sw846/sw-846-compendium. See Chapters 1, 2, 3, and 4.
- *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, (Revised March 1983).
- *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).
- *Methods for the Determination of Metals in Environmental Samples*, EPA/600/4-91/010 (June 1991) and Supplements.
- *Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater*, EPA 600/4-82-057 (July 1982) and 40 CFR Part 136, Appendix A.
- *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88/039 (December 1988) and Supplements.

- Standard Methods for the Examination of Water and Wastewater, 22th Edition (2012) and SM On-Line. See Introduction in Part 1000.
- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and EPA Method Update Rule 2007, 2012, and 2017.
- 40 CFR Part 141, National Primary Drinking Water Regulations and EPA Method Update Rule 2007.
- Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997.
- State-specific total petroleum hydrocarbon methods for the analysis of samples for gasoline, diesel, and other petroleum hydrocarbon products (Alaska, Arizona, California, Oregon, Washington, Wisconsin, etc.).
- Annual Book of ASTM Standards, Part 31, Water.
- U. S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-94/012 (February 1993).
- U. S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA-540/R-94/013 (February 1994).
- Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound, for USEPA and USACE (March 1986), with revisions through April 1997.
- WDOE 83-13, Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulations (March 1982) and as Revised (July 1983 and April 1991).
- Identification and Listing of Hazardous Waste, California Code of Regulations, Title 22, Division 4.5, Chapter 11.
- Analytical Methods for the Determination of Pollutants in Pulp and Paper Industry Wastewater, EPA 821-R-93-017 (October 1993).
- Analytical Methods for the Determination of Pollutants in Pharmaceutical Manufacturing Industry Wastewaters, EPA 821-B-98-016 (July 1998).
- National Council of the Pulp and Paper Industry for Air and Stream Improvement (NCASI).

Internal program-level QA documents are listed in Appendix I.

APPENDIX A – Glossary

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accreditation Body: The territorial, state or federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation.

Accreditation Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.

Analysis Date: The calendar date of analysis associated with the analytical result reported for an accreditation or experimental field of proficiency testing.

Analyst: The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation).

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.

Bias: The systematic distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample’s true value).

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards.

Calibration Standard: A substance or reference material used for calibration.

Certified Reference Material (CRM): Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability to a national metrology institute.

Chain of Custody: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: second column confirmation, alternate wavelength, derivatization, mass spectral interpretation, alternative detectors, or additional cleanup procedures.

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more useful form.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Field of Proficiency Testing (FoPT): Analytes for which a laboratory is required to successfully analyze a PT sample in order to obtain or maintain accreditation, collectively defined as: matrix, technology/method, analyte.

Finding: An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement.

Holding Time: The specified maximum time that can elapse between two specified sampling and/or analytical activities.

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish evaluate accuracy and bias for associated sample analyses.

Legal Chain of Custody Protocols: Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the client or program. These procedures are performed at the special request of the client and include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.

Limit of Detection (LOD): A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect.

Limit of Quantitation (LOQ): The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.

Lower Limit of Quantitation (LLOQ): A criteria specific to SW-846 8000 series methods. The LLOQ is the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be ≥ the lowest point in the calibration curve.

Matrix: The substrate of a test sample.

Matrix Duplicate: A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Measurement System: A method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).

Method: A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

National Institute of Standards and Technology (NIST): A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States National Metrology Institute (NMI).

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator.

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis.

Primary Accreditation Body (Primary AB): The TNI-NELAP accreditation body responsible for assessing a laboratory's total quality system, on-site assessment, and PT performance tracking for fields of accreditation.

Procedure: A specified way to carry out an activity or process. Procedures can be documented or not.

Proficiency Testing (PT): A means to evaluate a laboratory's performance under controlled conditions relative to a given set of criteria, through analysis of unknown samples provided by an external source.

Proficiency Testing Provider (PTP): A person or organization accredited by the TNI-approved Proficiency Testing Provider Accreditor to operate a TNI-compliant PT program.

Proficiency Testing Sample (PT Sample): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.

Proficiency Testing Study (PT Study): A single complete sequence of circulation of proficiency testing samples to all participants in a proficiency test program.

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Control: The overall system of technical activities that continually measures the performance of a process, item, or service against defined standards to verify that they meet the stated requirements. Also, the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality.

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system.

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC) activities.

Quality System Matrix: These matrix definitions be used for purposes of batch and quality control requirements:

Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, ground water effluents, and TCLP or other extracts.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples are grouped according to type of tissue (i.e. marine vs. plant).

Chemical Waste: A product or by-product of an industrial process that results in a matrix not otherwise defined.

Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.

Non-Aqueous Liquid: Any organic liquid, product, or solvent not miscible in water and with <15% settleable solids.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source.

Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.

Raw Data: The documentation generated during sampling and analysis that records the original work steps, observations, and measurements, whether performed by an analyst or instrument. This documentation includes, but is not limited to field notes, electronic data, analysis bench sheets, run/injection logs, printouts, chromatograms, instrument outputs, and handwritten records for calibration, sample preparation, and sample analysis for field samples and QC samples.

Reference Material: Material or substance one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or at a given location.

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Secondary Accreditation Body (Primary AB): A TNI-NELAP accreditation body responsible that accredits the laboratory based on the Primary AB accreditation and procedures.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system.

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.

Standard Operating Procedure (SOP): A written document that details the process for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the procedures for performing certain routine or repetitive tasks.

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

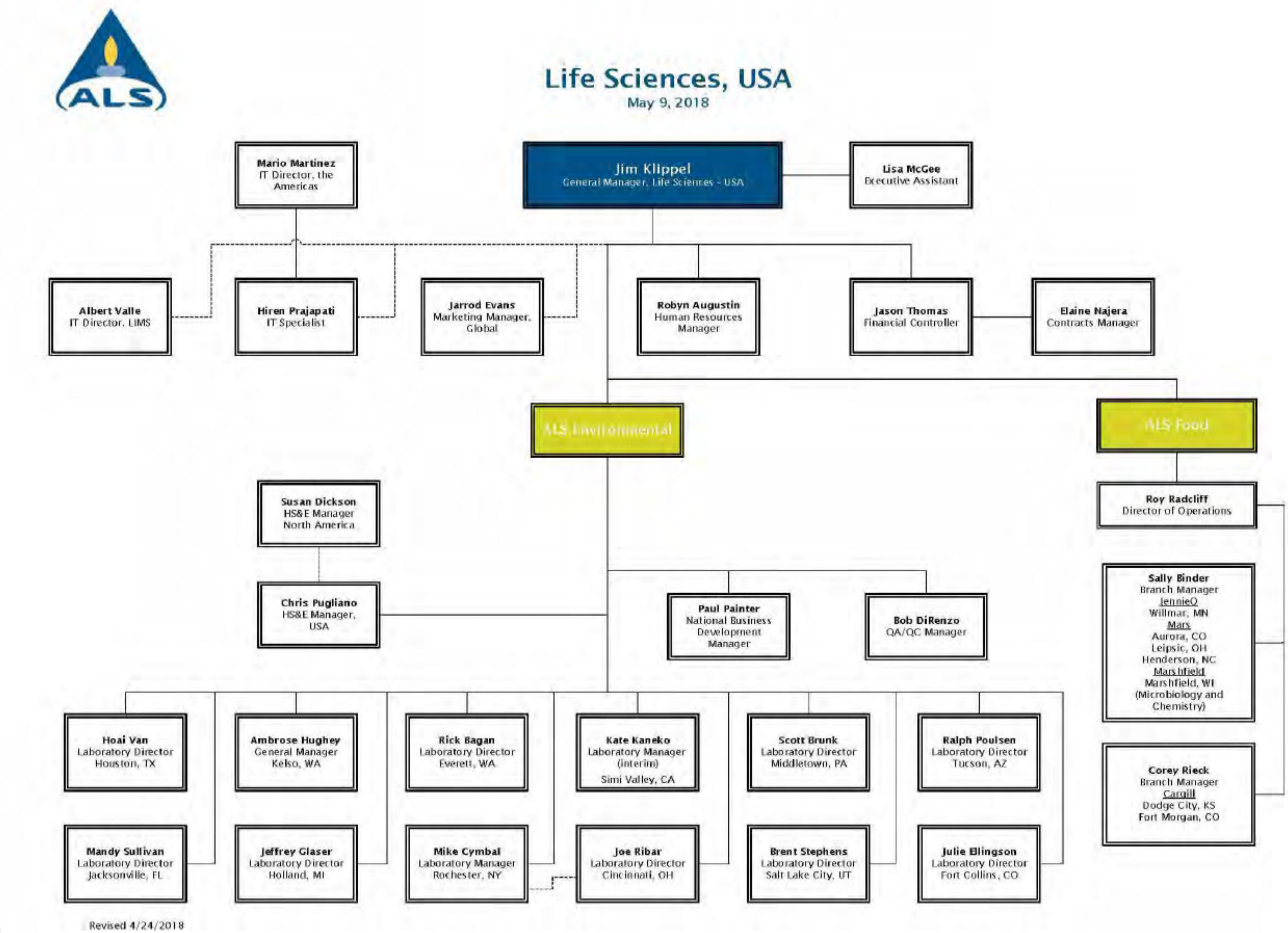
Verification: Confirmation by examination and objective evidence that specified requirements have been met.

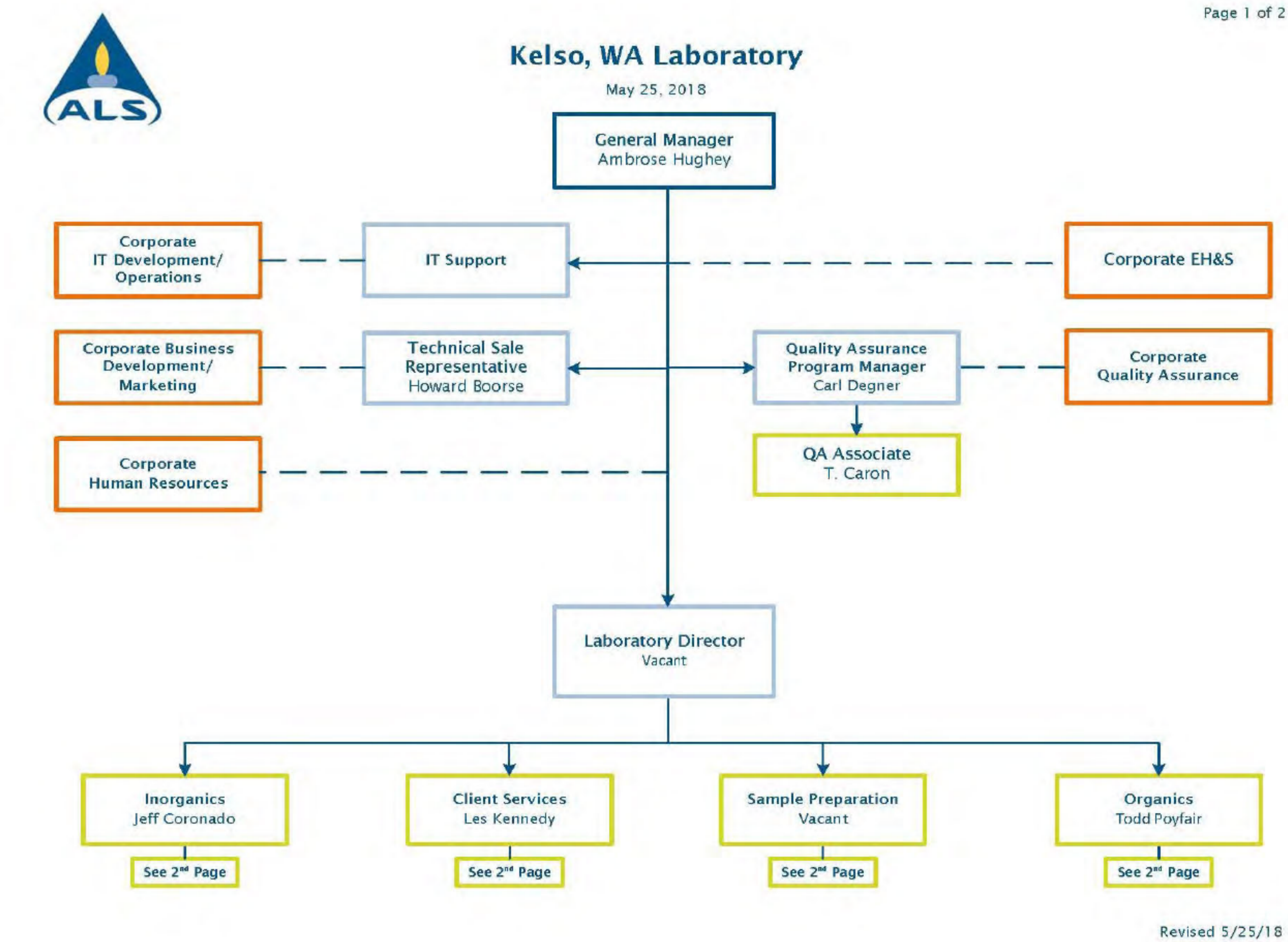
Acronyms

ASTM - American Society for Testing and Materials
A2LA - American Association for Laboratory Accreditation
CARB - California Air Resources Board
CAS - Number Chemical Abstract Service registry Number
CFC - Chlorofluorocarbon
CFU - Colony-Forming Unit
DEC - Department of Environmental Conservation
DEQ - Department of Environmental Quality
DHS - Department of Health Services
DoD - Department of Defense
DOE - Department of Ecology
DOH - Department of Health
EPA - U. S. Environmental Protection Agency
ELAP - Environmental Laboratory Accreditation Program
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
LOD - Limit of Detection
LOQ - Limit of Quantitation
LUFT - Leaking Underground Fuel Tank
M - Modified
MCL - Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL - Method Detection Limit
MPN - Most Probable Number
MRL - Method Reporting Limit
NA - Not Applicable
NC - Not Calculated
NCASI - National Council of the Paper Industry for Air and Stream Improvement
ND - Not Detected
NIOSH - National Institute for Occupational Safety and Health

PQL - Practical Quantitation Limit
RCRA - Resource Conservation and Recovery Act
SIM - Selected Ion Monitoring
TNI – The NELAC Institute
TPH - Total Petroleum Hydrocarbons

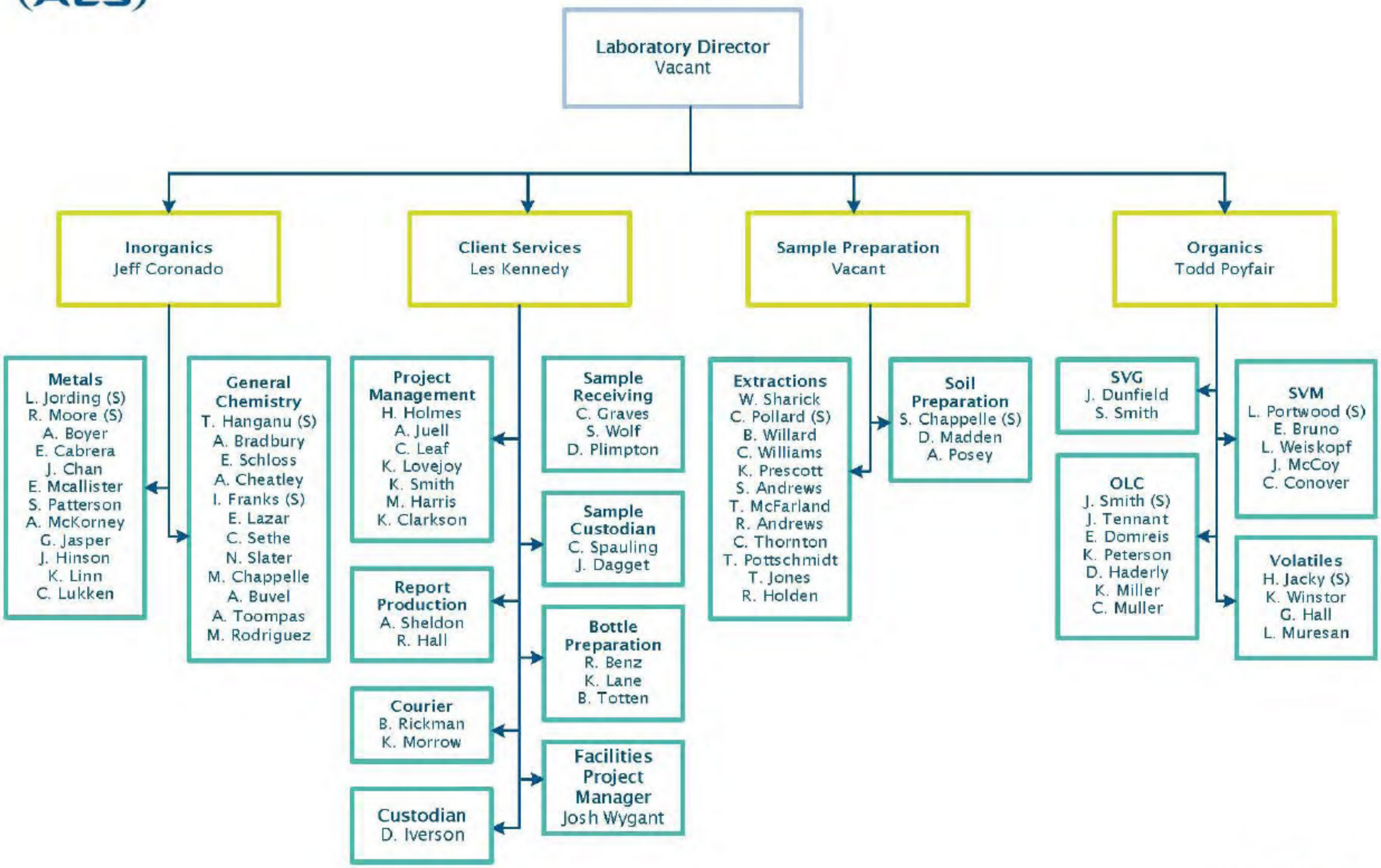
APPENDIX B – Organization Charts, Key Personnel, and Report Signatories


Life Sciences, USA
May 9, 2018
Jim Klippel
General Manager, Life Sciences - USA
Lisa McGee
Executive Assistant
Mario Martinez
IT Director, the Americas
Albert Valle
IT Director, LIMS
Hiren Prajapati
IT Specialist
Jarrod Evans
Marketing Manager, Global
Robyn Augustin
Human Resources Manager
Jason Thomas
Financial Controller
Elaine Najera
Contracts Manager
ALS Environmental
ALS Food
Roy Radcliff
Director of Operations
Susan Dickson
HS&E Manager
North America
Chris Pugliano
HS&E Manager, USA
Paul Painter
National Business Development Manager
Bob DiRenzo
QA/QC Manager
Sally Binder
Branch Manager
JennieO
Willmar, MN
Mars
Aurora, CO
Leipsic, OH
Henderson, NC
Marshfield
Marshfield, WI
(Microbiology and Chemistry)
Corey Rieck
Branch Manager
Cargill
Dodge City, KS
Fort Morgan, CO
Hoai Van
Laboratory Director
Houston, TX
Ambrose Hughey
General Manager
Kelso, WA
Rick Bagan
Laboratory Director
Everett, WA
Kate Kaneko
Laboratory Manager
(interim)
Simi Valley, CA
Scott Brunk
Laboratory Director
Middletown, PA
Ralph Poulsen
Laboratory Director
Tucson, AZ
Mandy Sullivan
Laboratory Director
Jacksonville, FL
Jeffrey Glaser
Laboratory Director
Holland, MI
Mike Cymbal
Laboratory Manager
Rochester, NY
Joe Ribar
Laboratory Director
Cincinnati, OH
Brent Stephens
Laboratory Director
Salt Lake City, UT
Julie Ellingson
Laboratory Director
Fort Collins, CO
Revised 4/24/2018


Page 1 of 2
Kelso, WA Laboratory
May 25, 2018
General Manager
Ambrose Hughey
Corporate IT Development/ Operations
IT Support
Corporate EH&S
Corporate Business Development/ Marketing
Technical Sale Representative
Howard Boorse
Quality Assurance Program Manager
Carl Degner
Corporate Quality Assurance
QA Associate
T. Caron
Corporate Human Resources
Laboratory Director
Vacant
Inorganics
Jeff Coronado
See 2nd Page
Client Services
Les Kennedy
See 2nd Page
Sample Preparation
Vacant
See 2nd Page
Organics
Todd Poyfair
See 2nd Page
Revised 5/25/18

Kelso, WA Laboratory

May 25, 2018



Revised 5/25/18

ALS Group USA, Corp.
1317 S. 13th Avenue
Kelso, WA 98626
T +1 360 577 7222 F +1 360 636 1068

Ambrose Hughey

General Manager, 2018 – Present
Kelso Laboratory

Responsible for all phases of laboratory operations at the Kelso Laboratory, including project planning, budgeting and quality assurance. Primary duties include the direct management and operational oversight of the Kelso laboratory and all department managers.

PREVIOUS EXPERIENCE

Western Region Business Manager, 2016 – 2018
ALS Tribology
Portland, OR

Responsible for achieving the budgeted financial performance and profitable growth of the western USA business as well assisting Lab Managers with monitoring ways to increase productivity and efficiency through equipment upgrading or new technology. Develop and maintain relationships with key customer accounts for western USA including, client visits, presentations, preparation of quotations and tenders as required. Ensure the regional business is run according to strategic and business plans.

Business Manager, Portland, 2010 – 2016
ALS Tribology
Portland, OR

Multiple site business/lab manager with duties similar to laboratory manager noted below. Promote the laboratories through client contact and formal presentations, including, client visits, presentations, preparation of quotations and tenders as required. Implement ISO 17025 and gain accreditation for each location.

Laboratory Manager, Portland, 2004 – 2010
ALS Tribology
Portland, OR

Ensure staff members have the training and skills to successfully complete the tasks assigned to their positions. Optimizing sample turnaround times to ensure timely delivery of reports to clients. Advise on the recommended purchase of capital equipment and preparing CEPs as required. Prepare the annual operating budget and meet/exceed the targets as specified in that budget.

EDUCATION

Southern Illinois University
Carbondale, Illinois
BS, Chemistry
(b) (6)

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Kelso, WA 98626
T +1 360 577 7222 F +1 360 636 1068

CARL DEGNER

Quality Manager, 2015 - Present
Kelso Laboratory

Directing the quality systems and ethics programs for the Kelso, WA laboratory facility. Responsible for ensuring that ALS quality systems and data integrity standards are implemented. Act as liaison with government entities involving quality, technical and operational issues. This includes maintaining accreditations and certifications, and maintaining all necessary documents (QA Manual, SOPs, and QA records). Act as primary point of contact during laboratory audits and provide audit responses and corrective actions. Coordinate performance audits (PE/PT testing) and conduct internal audits.

PREVIOUS EXPERIENCE

Technical Manager, SVM, 2011-2014
ALS Group USA, Corp.
Kelso, WA

Responsible for daily operation of Semi-volatiles GC/MS laboratory. This includes scheduling workloads of 3 analyst, data review, reporting and long-range planning for SVM laboratory. Work with PMs on client specific project requirements.

Technical Manager, SVM, 2001-2011
Columbia Analytical Services, Inc.
Kelso, WA

Same as above.

Scientist IV, SVM, 1998-2001
Columbia Analytical Services, Inc.
Kelso, WA

Responsible for all phases of operation of GC/MS systems, utilizing SIM and 8270C methodologies, including preparation of standards, QC verifications, data review, and reporting.

Project Chemist/Principal Organic Scientist, 1993-1998
Environ Express Laboratory
LaPorte, TX

Responsible for SV Extractions and GC/MS laboratories. Set up, operated, and maintained three HP GC/MS systems and worked with clients on technical issues.

EDUCATION

University of Houston -
Houston, TX
MS Environmental Management
(b) (6)

University of Houston -
Houston, TX
BS Biochemistry/Biophysical Science
(b) (6)

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Kelso, WA 98626
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EILEEN ARNOLD

Health, Safety and Environmental Manager, Western USA, 2015 – Present

Responsibilities include development, support and implementation of Environmental, Health and Safety policies for lab locations in the Western US, including national corporate policies for respiratory protection and hazardous waste generation. At the Kelso facility, also responsible for incident reporting and investigation, maintenance of all safety related equipment, review of monthly safety audits, and completion of all Federal and State mandated EH&S reports.

PREVIOUS EXPERIENCE

Scientist IV Metals Laboratory/Kelso Health and Safety Officer, 2012-2015
ALS Group USA, Corp.
Kelso, WA

Supervisor of the Metals reporting group responsible for ensuring timely, accurate reporting of all metals reports. Responsible for updating instrument specific data, such as MDL and control limits. Analyst for the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Also, Environmental, Health and Safety Officer.

Scientist IV Metals Laboratory/Kelso Health and Safety Officer, 1994-2012
Columbia Analytical Services, Inc.
Kelso, WA

Same as above.

Project Chemist, 1992–1994
Columbia Analytical Services, Inc.
Kelso, WA

Duties included technical project management and customer service. Responsible for meeting the clients' needs of timely and appropriate analyses, and to act as liaison for all client-related activities within Columbia Analytical Services, Inc.

EDUCATION

Immaculata College - Immaculata, PA
BS Chemistry
(b) (6)

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JEFF CORONADO

Manager – Specialty Laboratory Area, Metals Department Manager, 1992 – Present, General Chemistry Department Manager, 2017 – Present, Kelso Laboratory

Management of the Kelso General Chemistry and Metals Departments with a staff of 28 and annual revenues in excess of $5 million. Responsible for data quality and timeliness, revenues, expenses, workload coordination, method development efforts, and resource allocation. Participation in multiple LIMS development teams responsible for defining the ALS product.

PREVIOUS EXPERIENCE

Supervisor, GFAA Laboratory, 1989–1992
Columbia Analytical Services, Inc.
Kelso, WA

Responsibilities included supervision of metals analysis by graphite furnace atomic absorption following SW 846 and EPA CLP methodologies. Duties include workload scheduling, data review, instrument maintenance, personnel training and evaluation.

EDUCATION

Western Washington University – Bellingham, WA
BS Chemistry
(b) (6)

Western Washington University – Bellingham, WA
BA Business Administration
(b) (6)

Winter Conference on Plasma Spectrochemistry – Tucson, AZ (b) (6)

LC/ICP-MS Training Course – PerkinElmer, (b) (6)

Field Immunaossay Training Course – EnSys Inc., (b) (6)

Winter Conference on Plasma Spectrochemistry – San Diego, CA, (b) (6)

ICP-MS Training Course – VG-Elemental, (b) (6)

ALS Group USA, Corp.
10450 Stancliff Road, Suite 210
Houston, TX 77099
T +1 281 530 5656 F +1 281 530 5887

TODD POYFAIR

Organics Manager, 10/2017 – Present
Kelso Laboratory

Oversee the operation of the Volatiles, Semi-volatiles, and OLC laboratories. Responsibilities included organizing and prioritizing workload, training and development of staff, working with PMs on client-specific project requirements, workload coordination, method development efforts and resource allocation. Responsible for the quality and timeliness of analytical reports. Other responsibilities include ensuring compliance with ALS QA protocols, assisting staff with troubleshooting equipment, and procedural problems.

PREVIOUS EXPERIENCE

Technical Scientific and Business Development Representative, 2012-2017
ALS Group USA, Corp.
Kelso, WA
Worked with clients to define project requirements and expectations. Responsible for project development and technical project management, ensuring overall data quality and compliance with client requirements. Serve as liaison to clients and regulatory agencies functioning as a technical consultant to clients, coordinating technical proposals and sales for ALS Kelso.

Corporate IT Director / Vice President 2010-2012
Kelso, WA
Columbia Analytical Services
Phoenix, AZ

Laboratory Director / Vice President 2008-2010
Columbia Analytical Services
Phoenix, AZ
Responsible for all phases of laboratory operations at the Phoenix and Tucson Laboratories, including project planning, budgeting and quality assurance. Primary duties include the direct management and operational oversight of the Kelso laboratory and all department managers.

Department Manager 1993-2009
Columbia Analytical Services
Kelso, WA

EDUCATION

Portland State University
BS Chemistry
BA Foreign Language/German
(b) (6)

ADDITIONAL EXPERIENCE

Laboratory Manager
(b) (6)
Columbia Analytical Services, Kelso, WA

Chemist, Project Manager
(b) (6)
Columbia Analytical Services, Kelso, WA

ALS Group USA, Corp.
10450 Stancliff Road, Suite 210
Houston, TX 77099
T +1 281 530 5656 F +1 281 530 5887

Lester "Les" J. Kennedy

Client Services Manager 2017-Present
Kelso, WA

Management of the Client Services Departments: Project Management, Electronic Data Deliverables & Report Production, Sample Management, Sample Control , Bottle Preparation, General Lab Receiving & Shipping, and Courier Services. Oversee the client services for approximately $15 million in revenue annually. Responsible for employee supervision, workload coordination, and adherence to all standard operating procedures within the departments. Additional duties include the permit holder with direct oversight of the labs Quarantined Soil program as well as maintaining the ALS corporate US Fish and Wildlife import permits for US locations.

PREVIOUS EXPERIENCE

Support Services Manager 2012-2017
SMO Supervisor 2006-2012
ALS/Columbia Analytical Services, Inc.
Kelso, WA

Responsible for the operation of the Sample Management, Sample Control, and Bottle Preparation departments. Daily oversight of sample receiving, courier services, sample storage and disposal, bottle preparation and shipping, and general freight receiving.

Project Manager 1999-2006
Columbia Analytical Services, Inc.
Kelso, WA

Responsible for the technical project management ensuring overall data quality and compliance with customer requirements. Provided technical support to clients in project setup and data review. Additionally, acts as a consultant to clients regarding industrial & environmental compliance issues; serving as liaison between client and regulatory agencies.

Supervisor Organic Extractions Lab 1997-1999
Senior Analyst, GC/MS Department 1996-1997
Senior Analyst, Organic Extractions 1991-1996
Columbia Analytical Services, Inc.
Kelso, WA

Senior analyst and supervisor in the organic extractions department over an 8 year span. Responsibilities included sample preparation and cleanup; managing the workload; directing efficiencies; and ensuring that all critical hold times and QC requirements were met. Additional responsibilities included running GC/FID and GC/MS instruments and completing all steps in the data review and reporting processes.

EDUCATION

Lower Columbia College -
Longview, WA
General Sciences
Coursework for transfer
(b) (6)

Portland Bible College -
Portland, OR
BA Theology
(b) (6)

APPROVED SIGNATORIES FOR FINAL ANALYTICAL REPORTS

ALS Environmental, Kelso, WA

CLARKSON, KURT
CORONADO, JEFF
DEGNER, CARL
HARRIS, MARK
HOLMES, HOWARD
JACKY, HARVEY
JUELL, AMANDA
KENNEDY, LES
LEAF, CHRIS
LOVEJOY, KELLEY

Updated: June 20, 2018 Approved by: Les Kennedy, Client Services Manager

APPENDIX C

ALS Environmental Confidentiality Agreement

Confidentiality Agreement

The Confidentiality Agreement (the "Agreement") is entered into by and between ALS Group (hereinafter referred to as the "Company") and ___________________ (hereinafter referred to as "Employee").

WHEREAS, employee is presently employed by the Company in a position in which Employee will receive and have access to confidential business information and other secrets of the Company, and shall, to the best of Employee's ability, assist the Company in improving and developing the products and services of the Company; and

WHEREAS, employee is desirous of continuing such employment and receiving such disclosures of confidential business information, and assisting the Company in improving and developing its products and services.

NOW, this Agreement being a condition therefore and ancillary thereto, and in further consideration of the benefits to Employee pursuant to the employment by the Company, the receipt and sufficiency of all such consideration being hereby acknowledged by Employee, it is agreed between the Company and Employee as follows:

1. **Confidential Business Information.** Employee recognizes and agrees that the Company has certain confidential business information, including, but not limited to, compilations of information, customer lists, customer data, records, specifications, and trade secrets, and related business methods and techniques, which confidential business information are used by the Company to obtain a competitive advantage over the Company's competitors who do not know or use this information. Employee further recognizes and agrees that the protection of such confidential business information against unauthorized disclosure and use is of critical importance to the company to maintain its competitive position and Employee therefore agrees that use of, or disclose to any other person or entity, except as authorized by the Company in writing, any of the confidential business information of the Company. Employee also agrees not to disclose to the Company or utilize on the Company's behalf, any of the trade secrets or other confidential information of any of the Employee's former employers.

2. **Return of Confidential Business Information.** Upon termination of his employment for any reason, employee shall promptly deliver to the Company all drawings, manuals, letters, photographs, tapes or video recordings, records of any kind, and all copies thereof, that may be in the possession of, or under the control of, Employee pertaining to the Company's employers.

3. **Assignment of Rights to Company.** Employee agrees to assist the Company in all possible ways in the discovery, perfection, and development of new ideas, inventions, discoveries, devices, and methods in processes, all for the benefit of the Company and as its exclusive property. Employee agrees to and does hereby assign, transfer, and convey to the Company, or at the written direction of the Company and which are made, developed or conceived by Employee, either solely or jointly with others, during Employee's employment with the Company, whether prior or subsequent to the signing of this Agreement, whether made, developed or conceived by Employee during or outside of regular working hours or on or away from the

Company's premises or at Employee's expense, the expense of the Company or some other person or persons. At any time, the Employee shall execute such documents requested by the Company to confirm the rights of the Company in the ideas, inventions, discoveries, and devices, methods and processes referenced in this Section 3.

4. **Reasonableness of Covenants**. Employee specifically acknowledges and agrees as follow: (I) the covenants set forth in this Agreement are reasonable and necessary to protect the goodwill and the operations and business of the Company; (ii) the time duration of the covenants set forth in this Agreement and are reasonable and necessary to protect the goodwill and the operations and business of the Company; (iii) the geographical area limitations of the covenants set forth in this Agreement are reasonable and necessary to protect the goodwill and the operations and business of the Company; (iv) the covenants set forth in this Agreement are not oppressive to Employee and do not impose a greater restraint on Employee than is necessary to protect the goodwill and the operations and business of the Company.

5. **Remedies**. Employee recognizes that irreparable injury or damage will result to the business of the company in the event to the breach of any covenant contained in this Agreement and Employee therefore agrees that in the event of such breach on the part of the Employee, the Company shall be entitled, in addition to any legal or equitable remedies and damages available, to an injunction to restrain the violation thereof by Employee and all other persons action for or on behalf of Employee. Any claim of Employee against the Company shall not prevent the Company from enforcing any provision of this agreement. Further, in the event legal action is necessary to enforce any of Employee's obligations hereunder and the Company prevails in such legal action, the Company shall be entitled to a recovery of its attorney's fees expended in such action.

6. **Reformation**. Whenever possible, each provision of this agreement shall be interpreted in such manner as to be effective and valid under applicable law; provided, however, incase any on or more of the provisions contained in this Agreement shall, for any reason, be held to be invalid, illegal, or unenforceable in any respect, such invalidity, illegality, or unenforceability shall no affect any other provision of this agreement, and this Agreement shall be construed as if such invalid, illegal, or unenforceable provision had never been contained herein. Should a court of competent jurisdiction declare any of the provisions of this Agreement unenforceable due to any restriction of duration, territorial coverage, scene of activity, or otherwise, in lieu of declaring such provisions unenforceable, the parties hereto expressly authorize the court, to the extent permissible by law, to revise or reconstruct such provisions in a manner sufficient to cause them to be enforceable.

7. **Affiliates**. This agreement, and Employee's obligations hereunder, shall apply to any confidential business information, formulas, recipes, patterns, devices, secret inventions, processes, compilations of information, materials, ingredients, customer lists, records, specifications and trade secrets of any affiliate of the Company. For the purpose of this Agreement, the "affiliate" means any person that, directly or indirectly, controls, or controlled by, or is under common control with, another person'; "person" means any individual, corporation, partnership, joint venture, limited liability company, association, joint stock company, trust, unincorporated

organization or any other form of entity; and "control" means the power to direct or cause the direction of the management and policies of a person, directly or indirectly, whether through the ownership of voting securities by contract, or otherwise.

8. **Compelled Disclosure**. In the event that Employee is requested or required (by oral questions, interrogatories, requested for information or documents, subpoenas, civil investigative demand or similar process) to disclose any of the confidential business information of the Company, it is agreed that Employee will provide the Company with immediate notice of such request(s), so that the Company may seek an appropriate protective order or, if appropriate, waive Employee's compliance with this agreement. Employee agreed that, if in the absence of a protective order or the receipt of a waive hereunder, Employee is nonetheless, in the reasonable opinion of Employee's counsel, legally compelled to disclose the confidential business information of the Company or else stand liable for contempt or suffer other censure or penalty, Employee may, after prior notice to the Company, disclose such the confidential business information of the Company to the extent legally required.

9. **Indemnity**. Employee agrees to indemnify and hold harmless the Company, and its directors, officers, employees, agents, and attorneys, from and after the date hereof, against any and all actions, causes of action, claims, suites, proceedings, demands, assessments, demands, settlement, judgment, damages, loses, costs, and legal and other expenses arising out of or resulting from the breach or failure of Employee to Company with any covenant or agreement made herein.

10. **Choice of Law: Waiver of Trial by Jury**. This Agreement shall be construed in accordance with, and governed for all purposes by the laws of the State of Texas and obligations and undertakings of each of the parties to this contract shall be performable at Houston, Harris County. TO THE EXTENT NOT PROHIBITED BY APPLICABLE LAW, THE PARTIES HEREBY KNOWLINGLY, VOLUNTARILY, AND INTENTIONALLY WAIVE ANY RIGHT TO TRIAL BY JURY THAT THE COMPANY OR EMPLOYEE MAY HAVE IN ACTION OR PROCEEDING, IN LAW OR IN EQUITY, IN CONNECTION WITH THIS AGREEMENT, EACH PARTY REPRESENTS AND WARRANTS THAT NEITHER PARTY HAS REPRESENTED, EXPRESSLY, OR OTHERWISE THAT IT WILL NOT, IN THE EVENT OF LITIGATION, SEEK TO ENFORCE THIS RIGHT TO JURY TRIAL WAIVER. EACH PARTY ACKNOWLEDGES THAT THE OTHER PARTY HAS BEEN INCLUDED TO ENTER INTO THIS AGREEMENT BY, AMONG OTHER THINGS, THE PROVISIONS OF THE WAIVER.

11. **Waiver**. No waiver of any provision of this Agreement shall constitute a waiver of any other provision of this agreement, nor such waiver constitute a waiver of any subsequent breach of such provision.

12. **Acknowledgement of Receipt.** Employee acknowledges a receipt of a copy of this Agreement, which has been executed in multiple copies, all executed copies of that shall be deemed originals.

13. **No Promise of Employment.** It is expressly agreed that this Agreement is not a promise of future employment.

14. **Assignment**: **Survival.** This agreement shall not be assignable by Employee. This agreement and the obligations of Employee hereunder, shall survive the termination of Employee's employment with the Company.

15. **Entire Agreement**. This Agreement entered into by the Company and Employee, embodies the entire agreement and understanding between the Company and the Employee relating to the subject matter hereof, and supersedes all prior agreements and understandings relating to the employment and compensation of the Employee and may only be amended by a written agreement signed by all parties hereto.

Employee Signature: ____ Date: _____________

Employee Printed Name: ____________________________________

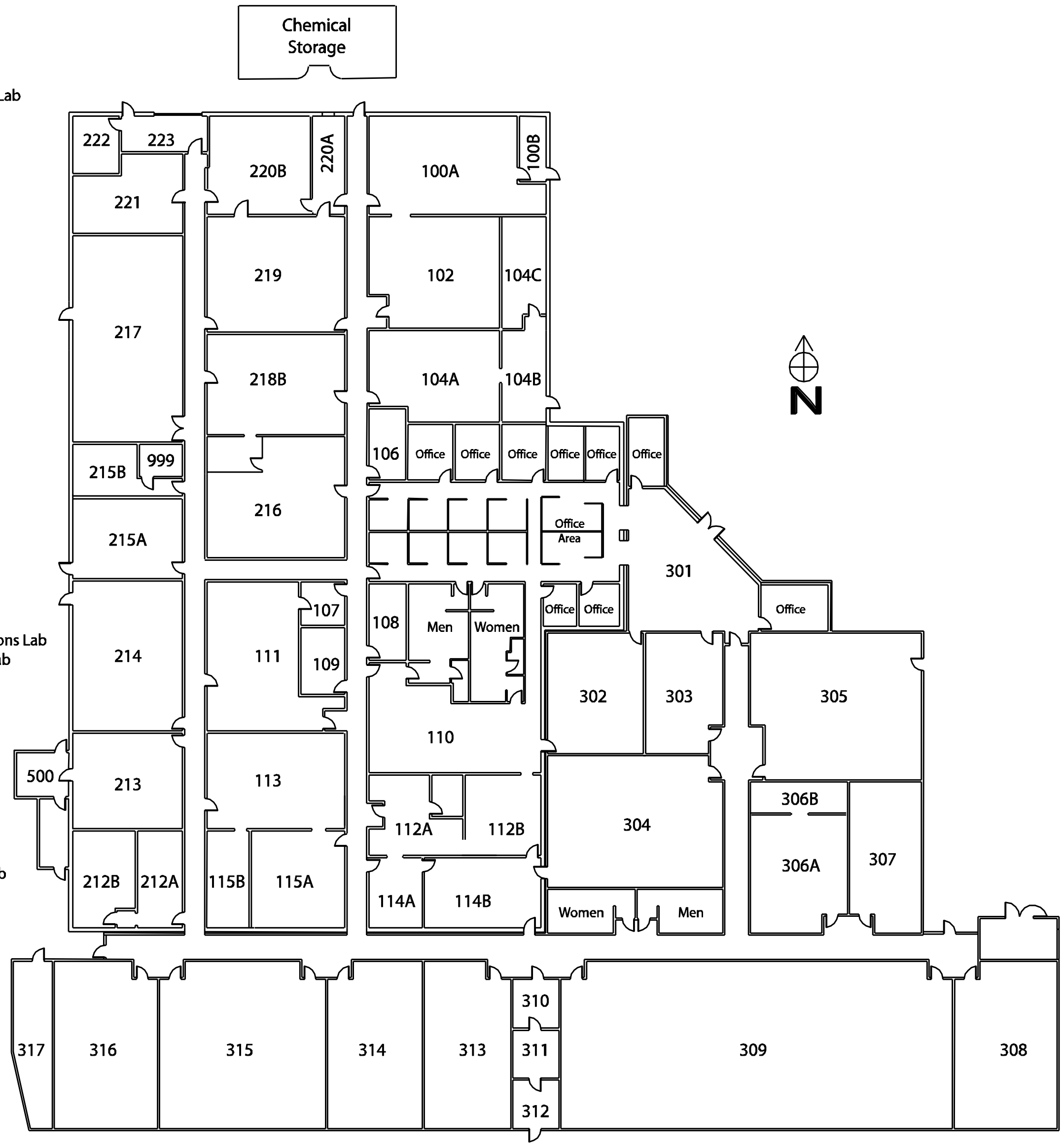
Witness: ____ Date: ___________

Witness Printed Name: ______________________________________

APPENDIX D – Laboratory Floor Plan

Room #	
100A	Semivolatile Organics GC Instrument Lab
100B	Electrical Room
102	Semivolatile Organics GC Office
104 A - C	Organics LC Labs and Offices
106	Deionized Water System Room
107	Oven Room
108	Zero Headspace Extraction Lab
109	Storeroom
110	Lunch Room
111	General Chemistry Lab
112A	Microbiology Lab
112B	Copy Center
113	ICP MS Lab
114A	Grain Size
114B	Total Solids/Oven Room
115A	ICP Lab
115B	Metals Reporting
212A	Mercury and Flame AA Lab
212B	Low Level Mercury Lab
213	General Chemistry Lab
214	General Chemistry Lab
215A	Drinking Water Lab
215B	Information Technology
216	Data Review & Storage
217	Sample Storage
218	Volatiles Organics Lab
219	Semivolatile Organics GC/MS Lab
220A	Semivolatile Organics GC/MS Office
220B	Semivolatile Organics GC/MS Extractions Lab
221	Drinking Water Sample Preparation Lab
222	Purchasing Office
223	General Receiving
301	Reception Lobby
302	Lunch Room
303	Conference Room
304	Sample Storage
305	Sample Receiving
306A	Pharmaceutical Metals
306B	Pharmaceutical Microbiology
307	Pharmaceutical Instrument Lab
308	Pharmaceutical General Chemistry Lab
309	Organics Sample Preparation Lab
310	Communication Room
311	Electrical Room
312	Fire Room/Water System
313	Glass Wash Room
314	Clean Room
315	Metals Digestion Room
316	Tissue Preparation
317	Mechanical
500	Janitorial Room
999	Computer Room

Revised 9/21/10



APPENDIX E – Analytical Equipment

GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balances (8):			
Sartorius, Mettler, Ohaus, Fisher	1990-2011	LM	13
Autoclave - Market Forge Sterilmatic	1988	LM	5
Autoclave – Heidolph Brinkman 3870EP	2010	LM	3
Autotitrator – Thermo Orion 500	2007	LM	2
Calorimeters (2):			
Parr 1241 EA Adiabatic	1987	LM	2
Parr 6300 Isoparabolic	2005	LM	2
Centrifuge - Damon/IEC Model K	1992	LM	13
Colony Counter - Quebec Darkfield	1988	LM	2
Conductivity Meter (1):			
YSI Model 3200	2004	LM	4
Digestion Systems (5):			
COD (3)	1989	LM	2
Kjeldahl, Lachat 46-place (1)	1999	LM	2
Skalar Micro Digester, 120 place (1)	2016	LM	2
Dissolved Oxygen Meter - YSI Model 5000, 5100 (2)	2006, 2009	LM	4
Distillation apparatus – Simple Dist – Hot Block (1)	2014	LM	3
Drying Ovens (7):			
Shel-Lab and VWR models	1990-2010	LM	13
Flash Point Tester (1):			
Petroleum Systems Services	2005	LM	3
Flow-Injection Analyzers (3):			
Bran-Leubbe	2002	LM	3
Lachat 8500	2007	LM	3
Skalar	2017	LM	3
Ion Chromatographs (4)			
Thermo/Dionex ICS-2500	2002	LM	3
Thermo/Dionex ICS-2000	2006	LM	3
Thermo/Dionex ICS-1600	2009	LM	3
Thermo/Dionex ICS-1600	2015	LM	3
Meters (ISE and pH) (4)			
Orion Dual Star	2016	LM	3
Orion Star A214	2016	LM	2
Symphony SB90M5	2013	LM	2
Symphony SP80P1	2012	LM	2
Muffle Furnace- Thermolyne 1300	1991	LM	13

Shatter Box (2): GP 1000 SPEX 8530	 1989 2011	 LM LM	 5 5
Sieve Shakers (2): CE Tyler - Portable RX 24 WS Tyler - RX 86	 1990 1991	 LM LM	 5 5
Total Organic Carbon (TOC) Analyzers (3) Coulemetrics Model 5012 Teledyne Tekmar Fusion 1 Analytik Jena 2500	 1997 2009 2013	 LM LM LM	 2 2 2
Total Organic Halogen (TOX) Analyzers (3): Mitsubishi TOX-100 (2) Mitsubishi AOX-200 (1)	2001 2015	 LM LM	 3 3
Turbidimeter - Hach Model 2100N	1996	LM	4
UV-Visible Spectrophotometers (2): Beckman-Coulter DU520 Perkin Elmer Lambda 25	 2005 2008	 LM LM	 4 4
Discrete Autoanalyzer – Westco SmartChem AD20-1	2011	LM	2
Vacuum Pumps (3): Welch Duo-Seal Model 1376	 1990	 LM	 13
Water Baths/Incubators (17): Various Fisher Scientific, VWR, and Shell Lab models	1986 - 2009	LM	13
Drill Press – Craftsman	2012	-	4
METALS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (8) Mettler AE 200 analytical balance Various Mettler, Sartorius, and Ohaus models	 1988-2010	 MM	 12
Atomic Absorption Spectrophotometers (4): Perkin Elmer AAnalyst 200 Flame AA CETAC Mercury Analyzer M-6100 Buck AA Spectrophotometer Model 205	 2005 2010 2008	 MM MM LM	 3 3 3
Atomic Fluorescence Spectrophotometer (2) Brooks-Rand Model III Brooks-Rand Merx	 2005 2014	 LM LM	 3 3
Centrifuge - IEC Model Clinical Centrifuge	1990	LM	12
Drying Oven - VWR Model 1370F	1990	LM	12
Environmental Express HotBlocks – 100 mL (4), 50 mL (4), 10 mL (1)	2000-2016	LM	6
Free Standing Oven – Shell Lab	2014	LM	6

Freeze Dryers (1) - Labconco	2006	LM	5
Glove Box – Plas Lab	2013	LM	2
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) (2) Thermo Scientific Model iCAP 6500 Thermo Scientific Model iCAP 6500	 2007 2012	 MM MM	 3 3
Inductively Coupled Plasma Mass Spectrometers (ICP-MS) (4): Agilent 7700 Agilent 7800 Nexion Model 300D	 2014 2016 2011	 MM MM MM	 2 2 2
Muffle Furnace (2) - Thermolyne Furnatrol - 53600	1991, 2005	LM	5
Shaker - Burrell Wrist Action Model 75	1990	LM	12
TCLP Extractors (3)	1989, 2002	LM	5
Turbidimeter – Hach			
SEMIVOLATILE ORGANICS SAMPLE PREPARATION LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (3) Mettler PM480, AG204, AE240 Sartorius LP3200D	 1999 - 2015 2016	 MM MM	 6
Centrifuge – Sorvall GLC-1 (2)	2014	LM	3
Drying Ovens (2) Fisher Model 655G VWR Model 1305U	 1991 1999	 LM LM	 3 3
Evaporators/concentrators Organomation N-Evap (7) Organomation S-Evap (7) Biotage Turbovap (3)	 1990-2010 1990-2010 2013 - 2016	 LM LM LM	 4 7 2
Extractor Heaters: Lab-Line Multi-Unit for Soxhlet and Continuous Liquid-Liquid Extractions (90)	1987-2007	LM	4
Solids Extractors: Sonic Bath VWR Sonic Horn (4) Soxtherm Gerhardt (4) OI Analytical (5)	 1994 1994 2000 2008	 LM LM LM LM LM	 3 3 2 2

Extractors, TCLP (8): Millipore TCLP Zero Headspace Extractors (10) TCLP 12 position Extractor/Tumbler (2)	 1992-2011 1989-2011	 LM LM	 1 1
Gel Permeation Chromatography (GPC) (4) J2 Scientific AccuPrep (3) Gilson (1)	 2005, 2010 2013	 LM LM	 2 2
Muffle Furnace (2)	2006, 2009	LM	1
Solid Phase Extractors (18) – Horizon SPE-Dex 4790	2003, 2006,2008	LM	4
Microwave Extractor – Mars 6	2014	LM	2
Edmund Buhler 3-Storey top frame VKS 'Shaker table' (1)	2016	LM	1
GC SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Gas Chromatographs (18): Agilent 6890 GC with Agilent 7683 Autosampler and Dual ECD Detectors (6) Agilent 6890 GC with Agilent 7683 Autosampler and Dual FPD Detectors Agilent 7890A Dual ECD Detectors Agilent 7683B autosampler (4) Hewlett-Packard 5890 GC with HP 7673 Autosampler and FID Detector Agilent 6890 with Dual FID Detectors and Agilent 7873 Autosampler (4) Agilent 7890A Dual NPD Detectors and Agilent 7683B autosampler	 2001, 2005, 2007,2011 2003 2010 - 2014 1995 2001, 2005 2012	 LM LM LM LM LM LM	 2 2 2 1 1 2
Varian Ion trap GC/MS: Varian 3800 GC w/CP8400 autosampler Varian Saturn 2100T mass spectrometer	2003 2006 2003	LM LM LM	1 1 1
Thermo Ion Trap ITQ-90C GC/MS w/TriPlus autosampler	2008	LM	1
GC/MS SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler AB 104-S	2000	MM	4

Semivolatile GC/MS Systems (11): Agilent 6890/5973 with ATAS Optic2 LVI and HP 7673 Autosampler (2)	1997, 2001	LM	3
Agilent 5890/5970 and HP 7673 Autosampler	1990	LM	3
Agilent 5890/5972 with ATAS Optic2 LVI and HP 7673 Autosampler (1)	1993, 1994	LM	3
Agilent 6890/5973 with ATAS Optic3 LVI and HP 7683 Autosampler	2005	LM	3
Agilent 6890/5973 with Agilent PTV Injector and 7683 Autosampler (2)	2007	LM	3
Agilent7890A/5975C with Agilent 7693 Autosampler (4)	2010 - 2011	LM	3
Semivolatile GC/MS/MS – Waters Quattro Micro GC MicroMass with Agilent 6890, Agilent PTV Injector, 7683B Autosampler	2008	MM	1
HPLC LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler AB1045	2013	MM	7
Drying Oven - Binder	-	LM	3
Evaporator – Turbo Vap, Biotage	2016	LM	7
Centrifuge (2) Beckman Coulter Eppendorf	 2002 2012	 LM LM	 7 7
High-Performance Liquid Chromatographs (3): Agilent 1260 Infinity with Diode Array UV Detector	2011	LM	2
High-Performance LC/MS (5) API 5000 LC/MS/MS and SIL-20AC autosampler AB Sciex 5500 and Shimadzu DGU 20A5	 2008 2011	 MM MM	 4 4
Shimadzu LC/MS 8050 with 2x LC-30AD UHPLC pumps and SIL-30AC MP autosampler	2016	MM	2
Shimadzu LC/MS 8050 with 2x LC-30AD UHPLC pumps and SIL-30AC MP autosampler	2016	MM	2
Sonic Bath	2016	LM	7
VOLATILE ORGANICS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler PE 160	1989	MM	4
Fisher Vortex Mixer	1989	LM	4

Drying Ovens (1): Boekel 107801	1989	LM	4
Sonic Water Bath - Branson Model 2200	1989	LM	4
Volatile GC/MS Systems (8): Agilent 5890/5970 Tekmar 3000 Purge and Trap Concentrator Dynatech ARCHON 5100 Autosampler Agilent 6890/5973 Tekmar 3100 Purge and Trap Concentrator Encon Centurion Autosampler Agilent 6890/5973 Tekmar Velocity Purge and Trap Concentrator Tekmar Aquatech Autosampler Agilent 7980A/5975C (2) Teledyne Tekmar-Atomx Agilent 6890/5973 Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler Agilent 7890/5977A Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler Agilent 7890B/5977B Teledyne Tekmar Atomx	 1989 1995 1996 2001 2001 2001 2005 2005 2005 2010, 2011 2010, 2011 2013 2013 2013 2014 2014 2014 2016 2016	 LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM	 4 4 4 4 4 4 4 4 4 3 3 4 4 4 4 4 4 3 3
Agilent 7890 GC with FID Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler Agilent 7890 GC with FID Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler	2013 2013 2016	LM LM	2 2

AUTOMATED DATA PROCESSING EQUIPMENT			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
1 - WAN: LIMS Sample Manager using Oracle 11gR2 Enterprise RDBMS running on Red Hat Enterprise Linux Advanced Server v.6.6 platform connected via DMVPN circuits (100 Mbps)	2013	LM	NA
1 - Network Server for reporting and data acquisition running Windows Server 2008 R2 with a 1.4 TB capacity, 1 - Application server running Windows Server 2008 R2	2012	LM	NA
Approximately 90+ HP (3015, 4000, 4014, 4050, 4200, 4250, 4300), Dell 1720dn, and Lexmark M5155 printers.	2010 - 2015	LM	NA
Approximately 220+ Dell/HP PC workstations	2010 - 2015	LM	NA

running Windows XP/Windows 7 on LAN connected via 100BT/1GigE network			
Microsoft Office 2013 Professional as the base office application suite for all PC workstations. Some systems using Microsoft Office 2003/2007/2010	1996 - 2014	LM	NA
E-mail via Exchange 2010 with webmail via Outlook Web Access. Microsoft Outlook 2013 is standard email client, with some using Outlook 2010	2011 - 2014	LM	NA
Facsimile Machines - Brother 4750e, Brother 2920, and Brother 1860	2005 - 2008	LM	NA
Copier/Scanners - BizHub 283, BizHub 600, BizHub 601 (2), BizHub 654, BizHUb754e (2), BizHub 951, BizHub 1050.	2005 - 2015	LM	NA
Target, MARRS, Stealth, Harold, Blackbird, EDDGE, CASLIMS, & LabCoat reporting software systems.	1998 - 2014	LM	NA
Data processing terminals (79) - EnviroQuant, Target, Saturn, MassHunter, Chromeleon, MassLynx, Insight.	1996 - 2016	LM	NA

APPENDIX F – Containers, Preservation and Holding Times

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Bacterial Tests				
Coliform, Colilert (SM 9223)	W, DW	P, Bottle or Bag	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Coliform, Fecal and Total (SM 9221, 9222D)	W, S, DW	P,G	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Enterococci (Enterolert)	W	P	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	8 hours
Inorganic Tests				
Acidity (SM 2310B)	W	P,G	Cool, 4°C	14 days[EPA]
Alkalinity (SM 2320B)	W, DW	P,G	Cool, 4°C	14 days[EPA]
Ammonia (SM 4500 NH_3)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Biochemical Oxygen Demand(SM 5210B)	W	P,G	Cool, 4°C	48 hours
Bromate (EPA 300.1)	W, DW	P,G	50mg/L EDA, cool to 4°C	28 days
Bromide (EPA 300.1)	W, DW	P,G	None Required	28 days
Chemical Oxygen Demand (SM 5220C)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Chloride (EPA 300.0)	W, DW	P,G	None Required	28 days
Chloride (EPA 9056)	W, S	P,G	Cool, 4°C	28 days
Chlorine, Total Residual (SM 4500 Cl F)	W, S	P,G	None Required	24 hours
Chlorite (EPA 300.1)	W, DW	P,G	50mg/L EDA, cool to 4°C	14 days
Chlorophyll-A (SM 11200H)	W	G Amber	Cool, 4°C	48 hours
Chromium VI (EPA 7196A)	W	P,G	Cool, 4°C	24 hours
Color (SM 2120B)	W, DW	P,G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination (EPA 335.4, 9010, 9012) (SM 4500 CN E,G)	W, S, DW	P,G	Cool, 4°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid	14 days
Cyanide, Weak Acid Dissociable (SM 4500 CN I)	W, S	P,G	Cool, 4°C, NaOH to pH >12	14 days

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Ferrous Iron (ALS SOP)	W, D	G Amber	Cool, 4°C	24 hours
Fluoride (EPA 300.0, 9056, SM 4500 F-C)	W, S	P,G	Cool, 4°C	28 days
Formaldehyde (ASTM D6303)	W	G Amber	Cool, 4°C	48 hours
Formaldehyde (NCASI 99.02)	W	G Amber	Cool, 4°C	14 days
Formaldehyde (NCASI 98.01)	W	G Amber	Cool, 4°C	28 days
Hardness (SM 2340C)	W, DW	P,G	HNO_3 to pH<2	6 months
Hydrogen Ion (pH) (SM 4500H B)	W, DW	P,G	None Required	Analyze immediately
Kjeldahl and Organic Nitrogen (ASTM D3590-89)	W	P,G	Cool, 4°C, H H_2SO_4 to pH<2	28 days
Nitrate (EPA 300.0)	W, DW	P,G	Cool, 4°C	48 hours
Nitrate (EPA 9056)	W, S	P,G	Cool, 4°C	48 hours
Nitrate-Nitrite (EPA 353.2)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Nitrite (EPA 300.0)	W, DW	P,G	Cool, 4°C	48 hours
Nitrite (EPA 353.2)	W, S	P,G	Cool, 4°C	48 hours
Nitrite (EPA 9056)	W	P,G	Cool, 4°C	48 hours
Nitrocellulose	S	G	Cool, 4°C	28 days
Oil and Grease, Hexane Extractable Material (EPA 1664)	W	G, Teflon Lined Cap	Cool, 4°C, H_2SO_4 or HCL to pH<2	28 days
Organic Carbon, Total (9060 & SM 5310 C)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Organic Carbon, Total (ASTM-D4129)	S	P,G	Cool, 4°C	28 days
Organic Halogens, Adsorbable (EPA 1650C)	W	G, Teflon Lined Cap	Cool, 4°C, HNO_3 to pH<2	6 months
Organic Halogens, Total (EPA 9020B)	W	G, Teflon Lined Cap	Cool, 4°C, H_2SO_4 to pH<2, No headspace	28 days
Orthophosphate (SM 4500 P-E)	W, DW	P,G	Cool, 4°C	48 hours
Oxygen, Dissolved (Probe) (SM 4500O G)	W, DW	G, Bottle and Top	None Required	Analyze immediately
Oxygen, Dissolved (Winkler)	W, DW	G, Bottle and Top	Fix on Site and Store in Dark	8 hours

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Perchlorate (EPA 314.0)	W, DW ,S	P,G	Protect from temp. extremes	28 days
Phenolics, Total (EPA 420.1, 9065)	W, S	G Amber	Cool, 4˚C, H_2SO_4 to pH<4	28 days
Phosphorus, Total (EPA 365.3)	W	P,G	Cool, 4˚C, H_2SO_4 to pH<2	28 days
Residue, Filterable (TDS) (SM 2540C)	W	P,G	Cool, 4˚C	7 days
Residue, Nonfilterable (TSS) (SM 2540D)	W	P,G	Cool, 4˚C	7 days
Residue, Settleable (SM 2540F)	W	P,G	Cool, 4˚C	48 hours
Residue, Total (SM 2540B)	W	P,G	Cool, 4˚C	7 days
Residue, Volatile (EPA 160.4)	W	P,G	Cool, 4˚C	7 days
Salinity (SM 2520 B)	W	P,G	Cool, 4˚C	28 days
Silica (SM 4500 SiO2 C & E)	W	P Only	Cool, 4˚C	28 days
Specific Conductance (SM 2510 B)	W, DW	P,G	Cool, 4˚C	28 days
Sulfate (EPA 300.0)	W, DW	P,G	Cool, 4˚C	28 days
Sulfate (EPA 9056)	W, S	P,G	Cool, 4˚C	28 days
Sulfide (9030/9034)	W, S	P,G	Cool, 4˚C, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfide (SM 4500 S_2 D)	W	P,G	Cool, 4˚C, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfide (SM 4500 S_2 F)	W	P,G	Cool, 4˚C, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfite (SM 4500 SO_3 B)	W	P,G	None Required	24 hours
Sullfides, Acid Voaltile	S	G	Cool, 4˚C	14 days
Surfactants (MBAS) (SM 5540 C)	W	P,G	Cool, 4˚C	48 hours
Tannin and Lignin (SM 5550B)	W	P,G	Cool, 4˚C	28 days
Turbidity (EPA 180.1)	W, DW	P,G	Cool, 4˚C	48 hours
Metals				

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Arsenic Species 1632	W	G	HCL to pH<2, Cool < 4°C	28 days
Mercury (1631E)	W	F	HCl to pH<2	90 days
Mercury (1631E)	S	F	Freeze < -15°C	1 Yr
Mercury (7471)	S	P,G	Cool, 4°C	28 days
Mercury (EPA 245.1, 7470, 7471)	W, DW	P,G	HNO_3 to pH<2	28 days
Metals (200.7, 200.8, 200.9, 6010, 6020)	W, DW	P,G	HNO_3 to pH<2	6 months
Metals (200.7, 200.8, 200.9, 6010, 6020)	S	G, Teflon Lined cap	Cool, 4°C	6 months
Methyl Mercury (1630)	W	F	HCL to pH<2, Cool < 4°C	6 months
Methyl Mercury (1630)	S	G	Frozen < -10 °C	6 months
Methyl Mercury (1630)	T	G, Teflon-Lined Cap	Frozen < -10 °C/Freeze dried	1 year
Volatile Organics				
Gasoline Range Organics (8015, NWTPH-Gx)	W	G, Teflon-Lined, Septum Cap	Cool, 4°C, HCl to pH<2, No headspace	14 days
Gasoline Range Organics (8015, NWTPH-Gx)	S	G, Teflon- Lined Cap	Cool, 4°C, Minimize Headspace	14 days
Purgeable Halocarbons (624, 8260)	W	G, Teflon-Lined, Septum Cap	No Residual Chlorine Present; HCl to pH<2, Cool, 4°C, No Headspace	14 days
Purgeable Halocarbons (624, 8260)	W	G, Teflon-Lined, Septum Cap	Residual Chlorine Present; 10% $Na_2S_2O_3$, HCl to pH<2, Cool, 4°C	14 days
Purgeable Halocarbons (8260)	S	G, Teflon- Lined Cap	Cool, 4°C, Minimize Headspace	14 days
Purgeable Halocarbons (8260)	S	Method 5035	Terracore/Encore device, Freeze at -20°C Methanol, Cool, 4C	48 hrs to prepare from device, 14 days after preparing.
Purgeable Halocarbons (8260)	S	Method 5035	Sodium Bisulfate Cool, 4°C	48 hrs to prepare, 14 days after preparation

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	W	G, Teflon-Lined,Septum Cap, No Headspace	No Residual Chlorine Present: HCl to pH<2, Cool, 4°C, No Headspace	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	W	G, Teflon-Lined,Septum Cap, No Headspace	Residual Chlorine Present: 10% $Na_2S_2O_3$, HCl to pH<2, Cool 4°C	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	G, Teflon- Lined Cap	Cool, 4°C, Minimize Headspace	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	Method 5035	Encore, Freeze at -20°C Methanol, Cool, 4C	48 hr to prepare from Encore, 14 days after preparation.
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	Method 5035	Sodium Bisulfate, Cool, 4°C	48 hr to prepare from Encore, 14 days after preparation
Acrolein, Acrylonitrile, Acetonitrile (624, 8260)	W	G, Teflon - Lined Septum Cap	Adjust pH to 4-5, Cool, 4°C, No headspace	14 days
2-chloroethyl vinyl ether (8260)	W	G, Teflon - Lined Septum Cap	Cool, 4°C, Minimize Headspace	7 days
Semivolatile Organics				
Nonylphenols	W	G, Teflon-Lined Cap	H_2SO_4 to pH<2, Cool, 4°C	28 days until extraction;40 days after extraction
Organotins (ALS SOP)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction;40 days after extraction
Otto Fuel		G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction;40 days after extraction
Methanol in Process Liquid NCASI 94.03	L	G, Teflon-Lined Cap	Cool, 4°C	30 days
HAPS – Condensates NCASI 99.01		G, Teflon-Lined Cap	Cool, 4°C	14 days
HAPS – Impinger/Canisters NCASI 99.02			Cool, 4°C	21 days

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Perfluorinated Compounds HPLC/MS/MS (537 Modified)	W,S, T	P	Cool, 4°C	14 days until extraction; 40 days after extraction
PBDE/PBB – ROHS GC/MS	W, S, T	G	Cool, 4°C	40 days after extraction
Pharma Personal Care Products (EPA 1694)	W, S	Amber G, Teflon-Lined Cap	Cool, < 6°C	7[f] days until extraction; 30 days after extraction
Nitroaromatics and Nitramines (EPA 8330B)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction; 40 days after extraction
Organic Acids HPLC/MS/MS	W	G, Teflon-Lined, Septum Cap	H_2SO_4 to pH<2, Cool, 4°C	7 days unpreserved, 14 days preserved
Perchlorate (EPA 6850)	W, S	P, G	Cool, 4°C	28 days to analysis (H_2O), 28 days to extraction, 28 days after prep (solid)
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics) (EPA 8015)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction, 40 days after extraction
Alcohols and Glycols (EPA 8015)	W, S	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Acid Extractable Semivolatile Organics (EPA 625, 8270)	W	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Base/Neutral Extractable Semivolatile Organics (EPA 625, 8270)	W	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Acid Extractable Semivolatile Organics (EPA 8270)	S	G, Teflon-Lined Cap	Cool, 4°C[g]	14 days until extraction; 40 days after extraction
Base/Neutral Extractable Semivolatile Organics (EPA 8270)	S	G, Teflon-Lined Cap	Cool, 4°C[g]	14days until extraction; 40 days after extraction

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Chlorinated Herbicides (EPA 8151)	W, S	G, Teflon-Lined Cap	Cool, 4˚C[g]	7[f] days until extraction; 40 days after extraction
Chlorinated Phenolics (EPA 1653)	W	G, Teflon-Lined Cap	H_2SO_4 to pH<2, Cool, 4˚C[g]	30 days until extraction; 30 days after extraction
Polynuclear Aromatic Hydrocarbons (EPA 625, 8270)	W, S	G, Teflon-Lined Cap	Cool, 4˚C, Store in Dark[g]	7[f] days until extraction; 40 days after extraction
Organochlorine Pesticides and PCBs (EPA 608, 8081, 8082, GC/MS/MS)	W, S	G, Teflon-Lined Cap	Cool, 4˚C	7[f] days until extraction; 40 days after extraction
Organophosphorus Pesticides (EPA 8141, GC/MS/MS)	W, S	G, Teflon-Lined Cap	Cool, 4˚C, Store in Dark[g]	7[f] days until extraction; 40 days after extraction
Nitrogen- and Phosphorus-Containing Pesticides (EPA 8141)	W,S	G, Teflon-Lined Cap	Cool, 4˚C[g]	7[f] days until extraction; 40 days after extraction
Drinking Water Organics				
EDB, DBCP, and TCP (EPA 504.1)	DW	G, Teflon-Lined Cap	Cool, 4˚C, 3 mg $Na_2S_2O_3$, No Headspace	14 days
Purgeable Organics (EPA 524.2)	DW	G, Teflon-Lined, Septum cap	Ascorbic Acid, HCl to pH≤2, Cool, 4˚C, No Headspace	14 days
PFAS (EPA 537.1)	DW	P	1.25g Trizma, Cool, 6˚C	14 days to extraction, 28 days after extraction.
Haloacetic Acids (EPA 552.2)	DW	G, Amber, Teflon-Lined Cap	100 mg/L NH_4Cl, Cool, 4˚C	14 days until extraction; 7 days after extraction
Toxicity Characteristic Leaching Procedure (TCLP)				
Semivolatile Organics (EPA 1311/8270)	HW	G, Teflon - Lined Cap	Sample: Cool, 4˚C, Store in dark[g]	14 days until TCLP extraction
			TCLP extract: Cool, 4˚C, Store in dark[g]	7 days until extraction; 40 days after extraction
Organochlorine Pesticides (EPA 1311/8081)	HW	G, Teflon Lined Cap	Sample: Cool, 4˚C	14 days until TCLP extraction

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
			TCLP extract: Cool, 4°C	7 days until extraction; 7 days after extraction
Chlorinated Herbicides (EPA 1311/8151)	HW	G, Teflon Lined Cap	Sample: Cool, 4°C	14 days until TCLP extraction
			TCLP extract: Cool, 4°C	7 days until extraction; 7 days after extraction
Mercury(EPA 1311/7470)	HW	P,G	Sample: Cool, 4°C	28 days until extraction
			TCLP extract: HNO_3 to pH<2	28 days after extraction
Metals, except Mercury (EPA 1311/6010)	HW	P,G	Sample: Cool, 4°C	180 days until extraction;
			TCLP extract: HNO_3 to pH<2	14 days until TCLP extraction
Volatile Organics (EPA 1311/8260)	HW	G, Teflon Lined Cap	Sample: Cool, 4°C , Minimize Headspace	14 days until TCLP extraction
			Extract: Cool 4°C, HCL to pH,2, No Headspace	14 days after extraction

a For EPA SW-846 methods the method listed generically, without specific revision suffixes
b DW = Drinking Water, W = Water; S = Soil or Sediment; HW = Hazardous Waste
c P = Polyethylene; G = Glass, F- Fluoropolymer
d For chlorinated water samples
e The maximum holding time dependent upon the geographical proximity of sample source to the lab.
f Fourteen days until extraction for soil, sediment, and sludge samples.
g If the water sample contains residual chlorine, 10% sodium thiosulfate is used to dechlorinate.

APPENDIX G – Standard Operating Procedures

General and Quality Assurance SOPs

SOP TITLE	SOP ID	Revision
Laboratory Ethics and Data Integrity	CE-GEN001	4.00
Records Management Policy	CE-GEN003	2.00
Preventive Action	CE-GEN004	1.00
Document Control	CE-GEN005	2.00
Data Recall	CE-GEN006	2.00
Procurement and Control of Laboratory Services and Supplies	CE-GEN007	2.00
Method Development	CE-GEN008	1.00
Establishing Standard Operating Procedures	CE-GEN009	3.00
Handling Customer Feedback	CE-GEN010	1.00
Assigning and TSR to a Project	CE-GEN011	0.00
Policy for the Use of Accreditation Organization Names, Symbols, and Logos	CE-GEN012	1.00
Policy for Continuous Quality Improvement	CE-GEN016	0.00
Internal Audits	CE-QA001	2.00
Manual Integration Policy	CE-QA002	2.10
Training Policy	CE-QA003	3.00
Qualification of Subcontract Laboratories	CE-QA004	2.00
Laboratory Management Review	CE-QA005	2.00
Proficiency Testing Sample Analysis	CE-QA006	2.00
Making Entries onto Analytical Records	CE-QA007	2.00
Nonconformance and Corrective Action	CE-QA008	3.00
Control Limits	CE-QA009	1.00
Estimation of Uncertainty of Analytical Measurements	CE-QA010	1.00
Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation	CE-QA011	1.00
Quality of Reagents and Standards	CE-QA012	1.00
New Instrument Suitability and Validation	CE-QA013	0.00
Quality Management System Summary	QMS01	0.00

LABORATORY SOPs

SOP TITLE	SOP ID	Revision
DATA ARCHIVING	ADM-ARCH	7
DOCUMENTING LABORATORY BALANCE AND TEMPERATURE CHECKS	ADM-BAL	7
SAMPLE BATCHES	ADM-BATCH	11
CONTROL CHARTING QUALITY CONTROL DATA	ADM-CHRT	4
DEPARTMENT OF DEFENSE PROJECTS LABORATORY PRACTICES AND PROJECT MANAGEMENT	ADM-DOD	7
DEPARTMENT OF DEFENSE PROJECTS LABORATORY PRACTICES AND PROJECT MANAGEMENT – QSM 5.0	ADM-DOD5	2
LABORATORY DATA REVIEW PROCESS	ADM-DREV	11
CONTINGENCY PLAN FOR LABORATORY EQUIPMENT FAILURE	ADM-ECP	5
METHOD VALIDATION DOCUMENTATION	ADM-MDLC	5
MANAGEMENT OF CHANGE	ADM-MOC	0
MANUAL INTEGRATION OF CHROMATOGRAPHIC PEAKS	ADM-MI	2
PROJECT MANAGEMENT	ADM-PCM	15
DATA REPORTING AND REPORT GENERATION	ADM-RG	9
REAGENT AND STANDARDS LOGIN AND TRACKING	ADM-RLT	6
SUPPORT EQUIPMENT MONITORING AND CALIBRATION	ADM-SEMC	14
SOFTWARE QUALITY ASSURANCE AND DATA SECURITY	ADM-SWQADATA	0
ALS KELSO TRAINING PROCEDURE	ADM-TRAIN	3
CHECKING VOLUMETRIC LABWARE	ADM-VOLWARE	6
COLIFORM, FECAL	BIO-9221FC	10
COLIFORM, TOTAL	BIO-9221TC	6
COLIFORM, TOTAL (MEMBRANE FILTER PROCEDURE)	BIO-9222B	1
COLIFORM, FECAL (MEMBRANE FILTER PROCEDURE)	BIO-9222D	5
COLILERT® , COLILERT-18®, & COLISURE®	BIO-9223	10
ENTEROLERT	BIO-ENT	3
HEPTEROTROPHIC PLATE COUNT	BIO-HPC	7
MICROBIOLOGY QUALITY ASSURANCE AND QUALITY CONTROL	BIO-QAQC	17
SHEEN SCREEN/OIL DEGRADING MICROORGANISMS	BIO-SHEEN	4

SOP TITLE	SOP ID	Revision
SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION	EXT-3510	12
ORGANIC COMPOUNDS IN WATER BY MICROEXTRACTION	EXT-3511	0
CONTINUOUS LIQUID - LIQUID EXTRACTION	EXT-3520	17
SOLID PHASE EXTRACTION	EXT-3535	7
SOXHLET EXTRACTION	EXT-3540	11
AUTOMATED SOXHLET EXTRACTION	EXT-3541	11
MICROWAVE EXTRACTION	EXT-3546	1
ULTRASONIC EXTRACTION	EXT-3550	12
WASTE DILUTION EXTRACTION	EXT-3580	7
SILICA GEL CLEANUP	EXT-3630	5
GEL PERMEATION CHROMATOGRAPHY	EXT-3640A	10
REMOVAL OF SULFUR USING COPPER	EXT-3660	8
REMOVAL OF SULFUR USING MERCURY	EXT-3660M	5
SULFURIC ACID CLEANUP	EXT-3665	6
CARBON CLEANUP	EXT-CARCU	5
DIAZOMETHANE PREPARATION	EXT-DIAZ	8
FLORISIL CLEANUP	EXT-FLOR	6
ORGANIC EXTRACTIONS GLASSWARE CLEANING	EXT-GC	7
PERCENT LIPIDS IN TISSUE	EXT-LIPID	6
EXTRACTION METHOD FOR ORGANOTINS IN SEDIMENTS, WATER, AND TISSUE	EXT-OSWT	9
PREPARATION OF REAGENTS AND BLANK MATRICES USED IN SEMIVOLATILE ORGANICS ANALYSIS	EXT-REAG	3
MEASURING SAMPLE WEIGHTS AND VOLUMES FOR ORGANIC ANALYSIS	EXT-WVOL	5
ZERO HEADSPACE EXTRACTION (EPA METHOD 3511)	EXT-ZHE	0
FACILITY AND LABORATORY CLEANING	FAC-CLEAN	4
OPERATION AND MAINTENANCE OF LABORATORY REAGENT WATER SYSTEMS	FAC-WATER	3
FLASHPOINT DETERMINATION - SETAFLASH	GEN-1020	8
COLOR	GEN-110.2	7
TOTAL SOLIDS	GEN-160.3	14

SOP TITLE	SOP ID	Revision
SOLIDS, TOTAL VOLATILE AND PERCENT ASH IN SOIL AND SOLID SAMPLES	GEN-160.4	8
SETTEABLE SOLIDS	GEN-160.5	6
HALIDES, ADSORBABLE ORGANIC (AOX)	GEN-1650	5
GRAVIMETRIC DETERMINATION OF HEXANE EXTRACTABLE MATERIAL (1664)	GEN-1664	11
ALKALINITY TOTAL	GEN-2320	11
HARDNESS, TOTAL	GEN-2340	10
DETERMINATION OF INORGANIC ANIONS IN DRINKING WATER BY ION CHROMATOGRAPHY	GEN-300.1	8
PERCHLORATE BY ION CHROMATOGRAPHY	GEN-314.0	14
CHLORIDE (TITRIMETRIC, MERCURIC NITRATE)	GEN-325.3	6
CHLORINE, TOTAL/FREE RESIDUAL	GEN-330.4	4
TOTAL RESIDUAL CHLORINE - METHOD 330.5	GEN-330.5	2
AMMONIA BY FLOW INJECTION ANALYSIS	GEN-350.1	14
NITRATE/NITRITE, NITRITE BY FLOW INJECTION ANALYSIS	GEN-353.2	10
PHOSPHORUS DETERMINATION USING COLORMETRIC PROCEDURE	GEN-365.3	13
PHENOLICS, TOTAL	GEN-420.1	15
AMMONIA AS NITROGEN BY ION SPECIFIC ELECTRODE	GEN-4500 NH3 E	8
DISSOLVED SILICA	GEN-4500 SIO2C	4
SILICA DETERMINATION USING SMARTCHEM METHOD	GEN-4500 SiO2E	2
ORTHOPHOSPHATE DETERMINATION USING COLORIMETRIC PROCEDURE	GEN-4500-P-E	2
SULFIDE, METHYLENE BLUE	GEN-4500S2D	4
SULFIDE, TITRIMETRIC (IODINE)	GEN-4500S2F	3
HALOGENS TOTAL AS CHLORIDE BY BOMB COMBUSTION	GEN-5050	4
BIOCHEMICAL OXYGEN DEMAND	GEN-5210B	6
HALIDES, ADSORBABLE ORGANIC (AOX) - SM 5320B	GEN-5320B	3
AQUATIC HUMIC SUBSTANCES	GEN-5510B	2
DETERMINATION OF METHYLENE BLUE ACTIVE SUBSTANCES (MBAS)	GEN-5540C	8
TANNIN AND LIGNIN	GEN-5550	8
HALIDES, TOTAL ORGANIC (TOX)	GEN-9020	9

SOP TITLE	SOP ID	Revision
HALIDES, EXTRACTABLE ORGANIC (EOX)	GEN-9020M	5
CATION-EXCHANGE CAPACITY OF SOILS – AMMONIUM ACETATE	GEN-9080	0
TOTAL SULFIDES BY METHYLENE BLUE DETERMINATION	GEN-9030	11
ACIDITY	GEN-ACIDITY	5
TOTAL CARBON IN SOIL	GEN-ASTM	12
SULFIDES, ACIDS VOLATILE	GEN-AVS	8
HEAT OF COMBUSTION	GEN-BTU	5
CHLOROPHYLL-a BY COLORIMETRY	GEN-CHLOR	4
TOTAL CYANIDES AND CYANIDES AMENABLE TO CHLORINATION	GEN-CN	19
CYANIDE, WEAK ACID DISSOCIABLE	GEN-CNWAD	2
CHEMICAL OXYGEN DEMAND	GEN-COD	9
CONDUCTIVITY IN WATER AND WASTES	GEN-COND	12
CORROSIVITY TOWARDS STEEL	GEN-CORR	2
HEXAVALENT CHROMIUM - COLORIMETRIC	GEN-CR6	15
STANDARD TEST METHODS FOR DETERMINING SEDIMENT CONCENTRATION IN WATER SAMPLES	GEN-D3977	2
CARBONATE (CO3) BY EVOLUTION AND COLUMETRIC TITRATION	GEN-D513-82M	2
SULFIDE, SOLUBLE DETERMINATION OF SOLUBLE SULFIDE IN SEDIMENT	GEN-DIS.S2	3
BULK DENSITY OF SOLID WASTE FRACTIONS	GEN-E1109	1
FREE CYANIDE IN WATER, WASTEWATER, AND SOIL BY MICRODIFFUSION	GEN-FCN	0
FDA EXTRACTABLES	GEN-FDAEX	3
FERROUS IRON IN WATER	GEN-FeII	5
FLUORIDE BY ION SELECTIVE ELECTRODE	GEN-FISE	10
FORMALDEHYDE COLORIMETRIC DETERMINATION	GEN-FORM	3
HYDROGEN HALIDES BY ION CHROMATOGTRAPHY (METHOD 26)	GEN-HA26	4
HYDAZINE IN WATER USING COLORIMETRIC PROCEDURE	GEN-HYD	2
TOTAL SULFUR FOR ION CHROMATOGRAPHY	GEN-ICS	3
ION CHROMATOGRAPHY	GEN-IONC	19
COLOR, NCASI	GEN-NCAS	4

SOP TITLE	SOP ID	Revision
NITROCELLULOSE IN SOIL	GEN-NCEL	2
OXYGEN CONSUMPTION RATE	GEN-O2RATE	1
CARBON, TOTAL ORGANIC DETERMINATION (WALKELY BLACK METHOD)	GEN-OSU	4
Ph IN SOIL AND SOLIDS	GEN-pHS	16
Ph IN WATER	GEN-pHW	16
PARTICLE SIZE DETERMINATION - ASTM PROCEDURE	GEN-PSASTM	4
PARTICLE SIZE DETERMINATION	GEN-PSP	9
SULFIDES, REACTIVE	GEN-RS	5
TOTAL SULFIDE BY PSEP	GEN-S2PS	2
SULFITE	GEN-SO3	3
SPECIFIC GRAVITY	GEN-SPGRAV	2
SOLIDS, TOTAL DISSOLVED (TDS)	GEN-TDS	13
THIOCYANATE	GEN-THIOCN	2
NITROGEN, TOTAL AND SOLUBLE KJELDAHL	GEN-TKN	15
TOTAL NITROGEN AND TOTAL PHOSPHORUS BY ALKALINE PERSULFATE DIGESTION NCASI METHOD TNTP-W10900	GEN-TNTP	1
TOTAL ORGANIC CARBON IN WATER	GEN-TOC	14
SOLIDS, TOTAL SUSPENDED (TSS)	GEN-TSS	13
TURBIDITY MEASUREMENT	GEN-TURB	7
GLASSWASHING FOR INORGANIC ANALYSES	GEN-WASH	5
PHARMACEUTICALS, PERSONAL CARE PRODUCTS AND ENDOCRINE DISRUPTING COMPOUNDS BY HPLC/TANDEM MASS SPECTROMETRY	LCP-1694	5
DETERMINATION OF SELECTED PERFLUORINATED ALKYL ACIDS IN DRINKING WATER BY SOLID PHASE EXTRACTION AND TANDEM	LCP-537	5
PERCHLORATE IN WATER, SOILS, AND SOLID WASTE USING LIQUID CHROMATOGRAPHY TANDEM MASS SPECTROMETRY (LC/MS/MS)	LCP-6850	1
ALDEHYDES BY HPLC	LCP-8315	7
Quantitative Determination of Carbamate Pesticides in Solid Matrices by High Performance Liquid Chromatography/Tandem Mass	LCP-8321(S)	1
Determination of Carbamates in Water by EPA 8321 Using LC Tandem Mass Spectrometry	LCP-8321W	2
NITROAROMATICS AND NITRAMINES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY(HPLC)	LCP-8330B	5
Acrylamide by High Performance Liquid Chromatography/tandem mass spectrometry (HPLC/MS/MS)	LCP-ACRYL	2
Dioctyl sulfosuccinate by High Performance Liquid Chromatography/tandem mass spectrometry (HPLC/MS/MS)	LCP-DOS	5

SOP TITLE	SOP ID	Revision
QUANTITATION OF NITROAROMATICS AND NITRAMINES IN WATER, SOIL, AND TISSUE BY LIQUID CHROMATOGRAPHY AND TANDEM MASS SPECTROMETRY (LC-MS/MS)	LCP-LCMS4	3
NITROGUANIDINE BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY	LCP-NITG	7
ORGANIC ACIDS IN AQUEOUS MATRICES BY HPLC	LCP-OALC	5
QUANTITATIVE DETERMINATION OF OPTICAL BRIGHTENER 220 By High Performance Liquid Chromatography (HPLC)	LCP-OPBr	1
OXYANIONS IN WATER USING LIQUID CHROMATOGRAPHY TANDEM MASS SPECTROMETRY (LC/MS/MS)	LCP-OXY	1
PERFLUORINATED COMPOUNDS BY HPLC/MS/MS	LCP-PFC	8
PERFLUORINATED COMOUNDS BY HPLC/MS/MS FOR DOD PROJECTS	LCP-PFCDOD	0
METHYL MERCURY IN SOIL AND SEDIMENT BY ATOMIC FLUORESCENCE SPECTROMETRY	MET-1630S	4
METHYL MERCURY IN TISSUE BY ALCOHOLIC POTASSIUM HYDROXIDE DIGESTION, ETHYLATION, PURGE AND TRAP, AND COLD VAPOR	MET-1630T	3
METHYL MERCURY IN WATER BY ATOMIC FLUORESCENCE SPECTROMETRY	MET-1630W	4
MERCURY IN WATER BY OXIDATION, PURGE&TRAP, AND COLD VAPOR ATOMIC FLUORES. SPECTROMETRY	MET-1631	14
DETERMINATION OF ARSENIC SPECIES BY HYDRIDE GENERATION CRYOGENIC TRAPPING GAS CHROMATOGRAPHY ATOMIC ABSORPTION	MET-1632	4
MERCURY IN WATER	MET-245.1	16
METALS DIGESTION	MET-3010A	15
METALS DIGESTION	MET-3020A	18
METALS DIGESTION	MET-3050B	15
CLOSED VESSEL OIL DIGESTION	MET-3051M	5
CLOSED VESSEL DIGESTION OF SILICEOUS AND ORGANICALLY BASED MATRICIES	MET-3052M	3
DETERMINATION OF METALS & TRACE ELEMENTS BY INDUCTIVELY COUPLED PLASMA-MS (METHOD 6020)	MET-6020	17
ARSENIC BY BOROHYDRIDE REDUCTION ATOMIC ABSORPTION	MET-7062	5
MERCURY IN LIQUID WASTE	MET-7470A	17
MERCURY IN SOLID OR SEMISOLID WASTE	MET-7471	19
SELENIUM BY BOROHYDRIDE REDUCTION ATOMIC ABSORPTION	MET-7742	6
BIOACCESSIBILITY OF METALS IN SOIL AND SOLID WASTE	MET-BIOACC	3
METALS DIGESTION OF AQUEOUS SAMPLES	MET-DIG	18
SAMPLE FILTRATION FOR METALS ANALYSIS	MET-FILT	4
METALS LABORATORY GLASSWARE CLEANING	MET-GC	8
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP/AES	MET-ICP	26

SOP TITLE	SOP ID	Revision
DETERMINATION OF METALS & TRACE ELEMENTS BY INDUCTIVELY COUPLED PLASMA-MS (METHOD 200.8)	MET-ICPMS	17
TRACE METALS IN WATER BY PRECONCENTRATION USING REDUCTIVE PRECIPITATION FOLLOWED BY ICP-MS	MET-RPMS	8.1
METALS AND SEMIVOLATILES SPLP EXTRACTION (EPA METHOD 1312)	MET-SPLP	2
WASTE EXTRACTION TEST (WET) PROCEDURE (STLC) for NONVOLATILE and SEMIVOLATILE PARAMETERS	MET-STLC	3
METALS AND SEMIVOLATILES TCLP EXTRACTION (EPA METHOD 1311)	MET-TCLP	9
SAMPLE PREPARATION OF BIOLOGICAL TISSUES FOR METALS ANALYSIS BY GFAA, ICP-OES, AND ICP-MS	MET-TDIG	5
TISSUE SAMPLE PREPARATION	MET-TISP	11
ANALYSIS OF WATER AND SOLID SAMPLES FOR ALIPHATIC HYDROCARBONS	PET-ALIPHAT	2
ANALYSIS OF WATER, SOLIDS AND SOLUBLE WASTE SAMPLES FOR SEMI-VOLATILE FUEL HYDROCARBONS	PET-SVF	15
ANALYSIS OF WATER AND SOLIDS SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS	PET-TPH	2
ANALYSIS OF SOLID AND AQUEOUS SAMPLES FOR STATE OF WISCONSIN DIESEL RANGE ORGANICS	PTE-WIDRO	5
BOTTLE ORDER PREPARATION AND SHIPPING	SMO-BORD	17
SAMPLE DISPOSAL	SMO-DISP	13
FOREIGN SOILS HANDLING TREATMENT	SMO-FSHT	12
SAMPLE RECEIVING	SMO-GEN	35
SAMPLE TRACKING AND INTERNAL CHAIN OF CUSTODY	SMO-SCOC	17
ORGANOCHLORINE PESTICIDES AND PCBs (METHOD 608)	SOC-608	9
1,2-DIBROMOETHANE (EDB) AND 1,2-DIBROMO-3-CHLORO-PROPANE (DBCP) IN AQUEOUS SAMPLES BY MICROEXTRACTION AND GAS	SOC-8011	1
1,2-DIBROMOETHANE (EDB) AND 1,2-DIBROMO-3-CHLORO-PROPANE (DBCP) IN SOLIDS BY MICROEXTRACTION AND GAS CHROMATOGRAPHY	SOC-8011S	1
GLYCOLS	SOC-8015	13
ORGANOCHLORINE PESTICIDES BY GAS CHROMATOGRAPHY: CAPILLARY COLUMN TECHNIQUE	SOC-8081	20
PCBS AS AROCLORS	SOC-8082Ar	18
CONGENER-SPECIFIC DETERMINATION OF PCBS BY GC/ECD	SOC-8082Co	15
DETERMINATION OF NITROGEN OR PHOSPHORUS CONTAINING PESTICIDES	SOC-8141	15
CHLORINATED HERBICIDES	SOC-8151	17
CHLORINATED PHENOLS METHOD 8151 MODIFIED	SOC-8151M	12
METHANOL IN PROCESS LIQUIDS AND STATIONARY SOURCE EMISSIONS	SOC-9403	9
HAZARDOUS AIR POLLUTANTS (HAPS) IN PULP AND PAPER INDUSTRY CONDENSATES	SOC-9901	6

SOP TITLE	SOP ID	Revision
HAPS AND OTHER COMPOUNDS IN IMPINGER/CANISTER SAMPLES FROM WOOD PRODUCTS FACILITIES	SOC-9902	5
ALCOHOLS	SOC-ALC	3
BUTYLTINS	SOC-BUTYL	14
CALIBRATION OF INSTRUMENTS FOR ORGANICS CHROMATOGRAPHIC ANALYSES	SOC-CAL	10
CONFIRMATION PROCEDURE FOR GC AND HPLC ANALYSES	SOC-CONF	8
DETERMINATION OF OTTO FUEL II IN WATER	SOC-OTTO	2
ALIQUOTING OF SAMPLES	SOILPREP-ALIQUOT	0
SUBSAMPLING AND COMPOSITING OF SAMPLES	SOILPREP-SUBS	0
1,2-DIBROMOETHANE, 1,2-DIBROMO-3-CHLOROPROPANE, AND 1,2,3-TCP BY GC	SVD-504	11
HALOACETIC ACIDS IN DRINKING WATER	SVD-552	8
CHLORINATED PHENOLICS BY IN-SITU ACETYLATION AND GC/MS	SVM-1653A	10
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS	SVM-625	8
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS - METHOD 8270D	SVM-8270D	5
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS - LOW LEVEL PROCEDURE	SVM-8270L	10
POLYNUCLEAR AROMATIC HYDROCARBONS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY SIM	SVM-8270P	10
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS SELECTED ION MONITORING	SVM-8270S	8
ANTRHAQUINONE IN PAPERBOARD BY GC/MS SELECTED ION MONITORING	SVM-AQ	0
QUANTITATIVE GEOCHEMICAL BIOMARKERS BY GC/MS SELECTIVE ION MONITORING	SVM-BIO	2
PCB CONGENERS BY GC/MS SELECTIVE IION MONITORING	SVM-CON	0
DIISOPROPYL METHYLPHOSPHONATE BY GC/MS SELECTIVE ION MONITORING	SVM-DIMP	0
NONYLPHENOLS ISOMERS AND NONYLPHENOL ETHOXYLATES	SVM-NONYL	6
ORGANOPHOSPHOROUS PESTICIDES BY GC/MS/MS	SVM-OPPMS2	2
CHLORINATED PESTICIDES BY GC/MS/MS	SVM-PESTMS2	5
POLYBROMINATED DIPHENYL ETHERS (PBDEs) AND POLYBROMINATED BIPHENYLS (PBBs) BY GC/MS	SVM-ROHS	2
PURGE AND TRAP FOR AQUEOUS SAMPLES	VOC-5030	10
PURGE AND TRAP/EXTRACTION FOR VOC IN SOIL AND WASTE SAMPLES , CLOSED SYSTEM	VOC-5035	12
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-524.2	17
VOLATILE ORGANIC COMPOUNDS IN WATER BY GC/MS SIM	VOC-524.2SIM	2

SOP TITLE	SOP ID	Revision
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-624	13
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-8260	20
VOLATILE ORGANIC COMPOUNDS BY GC/MS SELECTIVE ION MONITORING	VOC-8260S	3
VOA STORAGE BLANKS	VOC-BLAN	10
SAMPLE SCREENING FOR VOLATILE ORGANIC COMPOUNDS IN SOIL, WATER AND MISC. MATRICES	VOC-BVOC	8
GASOLINE RANGE ORGANICS BY GAS CHROMATOGRAPHY	VOC-GRO	12

APPENDIX H – Data Qualifiers

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

APPENDIX I – Controlled and Normative Documents

Internal QA Documents	Location
Quality Assurance Manual	Q:\QA Manual\QAM.rXX.DOC
ALS-Kelso Certifications/Accreditations	Cert_kel.xls (QA Dept.)
MDL/LOD/LOQ Tracking Spreadsheet	MDL_LIST_Master.xls
Technical Training Summary Database	TrainDat.mdb
Approved Signatories List	QAM App A
Personnel resumes/qualifications	HR Department
Personnel Job Descriptions	HR Department/QA Training Files
ALS – Kelso Data Quality Objectives	Kelso DQO table-QA Maintained.xls
Master Logbook of Laboratory Logbooks	QA Masterlog-001
Standard Operating Procedures and Spreadsheet	1_ Kelso SOP.xls
Proficiency Testing Schedule and Tracking Spreadsheet	PT_Schedule.xls
External Normative Documents	**Location**
USEPA Manual for the Certification of Laboratories Analyzing Drinking Water, 5th Edition, EPA 815-B-97-001 (January 2005)	QA Department and online access
USEPA 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and EPA Method Update Rule 2007, 2012, 2016.	QA Department and online access
USEPA 40 CFR Part 141, National Primary Drinking Water Regulations and EPA Method Update Rule 2007.	QA Department and online access
National Environmental Laboratory Accreditation Program (NELAP), 2003 Quality Standards.	QA Department
TNI: TNI Standard – Environmental Laboratory Sector, Volume 1, Management and Technical Requirements for Laboratories Performing Environmental Analysis, EL-V1-2009.	QA Department
Quality Standards. American National Standard General requirements for the competence of testing and calibration laboratories, ANSI/ISO/IEC 17025:2005(E).	QA Department
DoD Quality Systems Manual for Environmental Laboratories, Versions 4.2, 5.0, and 5.1.	QA Department and online access
Analytical Methods (see References section).	Laboratory Departments and Online access

APPENDIX J – Laboratory Accreditations

The list of accreditations, certifications, licenses, and permits existing at the time of this QA Manual revision is given below, followed by the entire primary NELAP and DOD ELAP accreditations (un-numbered attachments). Current accreditation information is available at any time by contacting the laboratory or viewing the ALS Global website www.alsglobal.com.

Program	Number
National Programs	
ISO:IEC 17025:2005	L18-129
DoD ELAP	L18-128
State Programs	
Alaska DEC CSLAP	17-004
Arizona DHS	AZ0339
Arkansas - DEQ	88-0637
California DHS	2795
Florida DOH	E87412
Hawaii DOH	-
Louisiana DEQ	3016
Maine DHS	WA01276
Minnesota DOH	053-999-457
Nevada DEP	WA35
New Jersey DEP	WA005
New York DoH	12060
North Carolina DWQ	605
Oklahoma DEQ	9801
Oregon - DOH (primary NELAP)	WA100010
South Carolina DHEC	61002
Texas CEQ	T104704427-16-11
Washington DOE	C544
Miscellaneous	
Foreign Soil Permit	USDA
Plant Import Permit	USDA
Controlled Substances Permit	US DEA
Controlled Substances Permit	WA DOH

END

OF

DOCUMENT